PB85-248441

Improved Mobile Source Exposure Estimation

Southwest Research Inst., San Antonio, TX

Prepared for

Environmental Protection Agency, Ann Arbor, MI

Mar 85

U.S. Department of Commerce
National Technical Information Service
NTIS

PB85-248441

United States
Environmental Protection
Agency

Office of Mobile Source Air Pollution Control
Emission Control Technology Division
2565 Plymouth Road
Ann Arbor, Michigan 48105

EPA 460/3-85-002
March 1985

Air

EPA

Improved Mobile Source Exposure Estimation

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA 460/3-85-002	2.	3. RECIPIENT'S ACCESSION NO. PB85 248441/AS
4. TITLE AND SUBTITLE IMPROVED MOBILE SOURCE EXPOSURE ESTIMATION		5. REPORT DATE March 1985
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Melvin N. Ingalls		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Southwest Research Institute 6220 Culebra Road San Antonio, Texas 78284		10. PROGRAM ELEMENT NO. Work Assignment 6
		11. CONTRACT/GRANT NO. 68-03-3162
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Protection Agency 2565 Plymouth Road Ann Arbor, Michigan 48105		13. TYPE OF REPORT AND PERIOD COVERED Final Report (1/84 to 6/84)
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This project was conducted to provide an improved estimate of nationwide annual person hours of exposure to non-reactive mobile source pollutants. National population estimates by hour of the day were developed using the population activity files for six neighborhood types from the EPA NAAQS Exposure Model (NEM) for CO, with the addition of three mobile source microenvironments (street canyons, tunnels and parking garages). The NEM neighborhood populations together with the mobile source microenvironment populations constitute a complete hour-by-hour assignment of the nationwide population to a set of location types. Mobile source pollutant concentrations for the six NEM neighborhoods were derived from 1981 CO monitor data contained in the EPA SAROAD data base. Mobile source pollutant concentrations for the three mobile source microenvironments were derived for data in the literature. A computer program was written to combine the population and pollutant concentration distributions by hour of the day to produce an annual person hours of exposure distribution of mobile source pollutants. If the mobile source emission rate of a pollutant is known, the information in this report can be used to determine the person hours of exposure to various concentrations of that pollutant.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Exhaust Emissions Motor Vehicles	Exposure Estimates Parking Garages Tunnels Street Canyons	

18. DISTRIBUTION STATEMENT Release Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 212
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE 22.95

EPA Form 2220-1 (9-73)

EPA 460/3-85-002

Improved Mobile Source Exposure Estimation

by

Melvin N. Ingalls

Southwest Research Institute
6220 Culebra Road
San Antonio, Texas 78284

Contract No. 68-03-3162
Work Assignment 6

EPA Project Officers: Robert J. Garbe
Craig A. Harvey
EPA Branch Technical Representative: Robert I. Bruetsch

Prepared for

ENVIRONMENTAL PROTECTION AGENCY
Office of Mobile Source Air Pollution Control
Emission Control Technology Division
2565 Plymouth Road
Ann Arbor, Michigan 48105

March 1985

This report is issued by the Environmental Protection Agency to report technical data of interest to a limited number of readers. Copies are available free of charge to Federal employees, current contractors and grantees, and nonprofit organizations - in limited quantities - from the Library Services Office, Environmental Protection Agency, 2565 Plymouth Road, Ann Arbor, Michigan 48105.

This report was furnished to the Environmental Protection Agency by Southwest Research Institute, 6220 Culebra Road, San Antonio, Texas, in fulfillment of Work Assignment No. 6 of Contract No. 68-03-3162. The contents of this report are reproduced herein as received from Southwest Research Institute. The opinions, findings, and conclusions expressed are those of the author and not necessarily those of the Environmental Protection Agency. Mention of company or product names is not to be considered as an endorsement by the Environmental Protection Agency.

Publication No. EPA 460/3-85-002

FOREWORD

This project was conducted for the U.S. Environmental Protection Agency by the Department of Emissions Research of Southwest Research Institute. The project was begun in January 1984 and completed in June 1984. The project was conducted under Work Assignment 6 of Contract 68-03-3162, and was identified within Southwest Research Institute as Project 03-7338-006.

Mr. Robert J. Garbe of the Emission Control Technology Division, Office of Mobile Source Air Pollution Control, Environmental Protection Agency, Ann Arbor, Michigan, served as EPA Project Officer. Mr. Robert I. Bruetsch, of the same EPA Division was the Branch Technical Representative. Mr. Charles T. Hare, Manager, Advanced Technology, Department of Emissions Research, Southwest Research Institute, served as the Project Manager. The project was under the supervision of Melvin N. Ingalls, Senior Research Engineer, who served as Project Leader and principal investigator. Ms. Pamela Nickoloff, laboratory assistant, assisted with the programming and computer runs required for the project.

Sections III and V of this report are modified versions of Sections III and IV from "Mobile Source Exposure Estimation," EPA 460/3-84-004, the final report to EPA by Southwest Research Institute for Work Assignment 6 of Contract 68-03-3073. The information is repeated here to provide, in one volume, a complete explanation of the mobile source exposure estimation data base.

TABLE OF CONTENTS

Page

FOREWORD iii

LIST OF FIGURES vii

LIST OF TABLES ix

SUMMARY xi

I. INTRODUCTION 1

II. NEM N/M POLLUTANT CONCENTRATIONS 7

III. MOBILE SOURCE MICROENVIRONMENT POLLUTANT CONCENTRATIONS 13

IV. NEM NEIGHBORHOOD/MICROENVIRONMENT POPULATION 35

V. MOBILE SOURCE MICROENVIRONMENT POPULATIONS 51

VI. NATIONAL NEIGHBORHOOD POPULATION 77

VII. RURAL EXPOSURE 89

VIII. PERSON HOUR EXPOSURE COMPUTER PROGRAM 91

IX. CONCLUSIONS AND RECOMMENDATIONS 101

REFERENCES 103

APPENDICES

A. SUPPORTING INFORMATION FOR CO CONCENTRATIONS IN DIFFERENT NEIGHBORHOODS

B. SUPPORTING MATERIAL FOR CO CONCENTRATIONS FROM MOBILE SOURCE MICROENVIRONMENTS

C. SUPPORTING MATERIAL FOR NATIONAL POPULATION BY NEIGHBORHOOD TYPE

D. SUPPORTING INFORMATION FOR NATIONAL POPULATION ESTIMATE BY N/M TYPE

E. LISTING OF MOBEX COMPUTER PROGRAM

LIST OF FIGURES

Figure		Page
III-1	Parking Garage CO Concentration Distribution, 25 Percent Active Cars, Average Wind Speed	16
III-2	Wind Speed Distribution, Average of Seven U.S. Cities	18
III-3	CO Concentration as a Function of Hourly Percent ADT for the Sumner Tunnel (1961)	22
III-4	CO Concentration as a Function of Hourly Percent ADT for an Average Roadway Tunnel	24
IV-1	Pattern of Neighborhood Types in a Portion of the Philadelphia Study Area	36
IV-2	Chicago Study Area	37
IV-3	Philadelphia Study Area	38
IV-4	St. Louis Study Area	39
IV-5	Los Angeles Study Area	40
V-1	Hourly Average Cars in Motion for Weekdays in Parking Garages	54
V-2	Hourly Average Cars in Motion for Saturdays in Parking Garages	55
V-3	Hourly Average Cars in Motion for Sundays in Parking Garages	56
V-4	Hourly Tunnel Traffic for Weekdays	59
V-5	Hourly Tunnel Traffic for Weekends	60
V-6	Number of Person Trips to CBD per Person in Urban Areas	63
V-7	Hourly Traffic Distribution in the CBD for an Average Weekday	66

LIST OF FIGURES (CONT'D).

Figure		Page
V-8	Hourly Traffic Distribution in the CBD for Saturday	69
V-9	Hourly Traffic Distribution in the CBD for Sunday	70
V-10	Pedestrians for Individual Days of the Week as a Percent of Total Weekly Pedestrians	71
V-11	Hourly Pedestrian Distribution in the CBD for Weekdays	72
V-12	Hourly Pedestrian Distribution in the CBD for Saturdays	73
VI-1	Pictorial Representation of the U.S. as One Urban Area	78
VI-2	Percent of Urbanized Area Center City That Is Urban Core	82
VIII-1	Block Diagram of Person Hour Exposure Computer Program, MOBEX	93

LIST OF TABLES

Table		Page
II-1	Summary of CO Monitors Selected for Mobile Source Exposure Estimate	8
II-2	1981 CO Emission Factors used for Each Neighborhood or Microenvironment	9
II-3	Best Estimate of CO Scaling Factor for NEM Microenvironments	10
III-1	CO Levels Found in Parking Garages	15
III-2	Probability Distribution Parameters for Parking Garage Pollutant Distributions	19
III-3	Final Parking Garage Pollutant Concentration Distribution	20
III-4	CO Levels Found in Urban Commuter Tunnels	21
III-5	Pollutant Concentration Intervals for Roadway Tunnels	26
III-6	Distributions of Hourly Average CO Levels in Roadway Tunnels	27
III-7	SAROAD CO Monitors used in Street Canyon Analysis	28
III-8	Descriptive Statistics for Street Canyon CO Readings	30
III-9	Distribution of Hourly Average CO Levels in Street Canyons	31
III-10	Conversion Table of Measured PPM CO to $\mu g/m^3$ for 1 g/min Emission Factor	33
IV-1	Geographic Classification of NEM CO Study Area Districts	41
IV-2	Assumptions Concerning Work NT's of A-O Groups	42
IV-3	Description and Apportionment of Activity Pattern Subgroups	44
IV-4	A-O Group Population by District Classification in Four Cities	46

LIST OF TABLES (CONT'D).

Table		Page
IV-5	Collapsed Home-to-Work Trip Tables, Expressed as Number of Trips and Fraction of Trips	47
V-1	Parking Garage Construction in the U.S., 1967-1982	52
V-2	Nationwide Person Hours of Exposure in Parking Garages by Hour of the Day	57
V-3	Traffic Distribution by Day of the Week for Several Situations	58
V-4	Nationwide Person Hours of Exposure in Tunnels by Hour of the Day	62
V-5	Estimated CBD Daily Traffic as a Percent of Weekly Traffic	64
V-6	Daily Person Trips and Vehicles in Street Canyons	65
V-7	Nationwide Person Hours of Exposure in Street Canyons by Hour of the Day	75
VI-1	NEM CO Study Urban Area Classification	80
VI-2	Classification of Urban Areas by Percent of Residents in Urban Core (Based on 1980 Census)	83
VI-3	National Population for Weekday	85
VI-4	National Population for Saturday	86
VI-5	National Population for Sunday	87
VI-6	Explanation of Neighborhood/Microenvironment (N/M) Codes used in this Project	88
VII-1	Rural Exposure to Mobile Source Pollutants	90
VIII-1	Exposure Computer Program Input	95
VIII-2	Example Input Format for Exposure Computer Program	99
VIII-3	Sample of Exposure Program Output	99

SUMMARY

This project was conducted to provide an improved estimate of nationwide annual person hours of exposure to non-reactive mobile source pollutants. It extends the work done under EPA Contract 68-03-3073, Work Assignment 6. In this project, the population activity files from the EPA NAAQS Exposure Model (NEM) for CO, were used as the basis for national population estimates by hour of the day in six neighborhood types (center city residential, center city commercial, center city industrial, suburban residential, suburban commercial, suburban industrial). In this report, the use of the term "neighborhood" generally means these six areas. Occasionally, because material from other studies is used, the term "neighborhood" may be used as the designation for all urban or all suburban areas.

Populations in three mobile source microenvironments (street canyons, tunnels and parking garages), developed under Work Assignment 6 of Contract 68-03-3073, were included in the nationwide population estimates. Since these populations were calculated independently of the NEM neighborhoods, it was necessary to subtract a number of people equivalent to the mobile source microenvironment populations from the NEM neighborhood microenvironment populations. The corrected NEM neighborhood populations together with the mobile source microenvironment populations constitute a complete hour-by-hour assignment of the nationwide population to a set of location types.

Pollutant concentrations for the six NEM neighborhoods were developed using 1981 CO monitor data from the EPA Storage and Retrieval of Aerometrics Data (SAROAD) data base. Data from a total of 99 monitors were used to develop CO concentration frequency distributions for each neighborhood type. For each neighborhood, six different CO distributions were developed by dividing the 24 hour day into 6 intervals for each of three day types (weekdays, Saturdays, and Sundays). This process resulted in a total of 108 CO frequency distributions to represent the nationwide mobile source ambient pollutant concentrations in the neighborhoods. Within each neighborhood there were several microenvironments. The pollutant concentrations in these microenvironments were determined by multiplying the neighborhood distribution values by a different factor for each microenvironment.

The CO concentrations in these distributions were divided by the 1981 CO emission factors (in terms of grams per minute calculated from grams per mile emission factors using the appropriate average speed) from the MOBILE3 computer program that were appropriate for each neighborhood type. The resulting concentrations were equivalent to concentrations that would be produced from a one gram per minute emission factor. Concentrations for any pollutant, at any emission rate, can then be obtained by multiplying the distribution concentrations by the appropriate emission factors for that pollutant.

The pollutant concentrations in the three mobile source microenvironments, developed under Work Assignment 6 of Contract 68-03-3073, were used as the mobile source microenvironment concentrations for this study. The concentrations for these microenvironments were also equivalent to

those resulting from a one gram per minute emission factor. Grams per minute were used as the emission factor units to allow the use of an idle emission factor in parking garages.

Person hours of exposure to any pollutant can be obtained by multiplying the hourly population in each environment by each of the frequencies in the pollutant frequency distribution for that hour. The total nationwide person hours can be obtained by summing all hours and all environments. The pollutant concentration levels corresponding to the various frequencies are obtained by multiplying the concentration resulting from a one gram per minute emission factor by the pollutant emission factor. Since the emission factor in every environment is different, this calculation must be done for each environment.

A computer program was written, and provided to EPA, which performs all the necessary calculations to produce a cumulative frequency distribution of person hours of exposure at or above a list of specified pollutant concentrations. The inputs to the computer program include urban and rural populations for the year being studied, the study year emission factors for the pollutant for each environment by day type, and the output distribution pollutant concentration intervals, if desired. As an example, the nationwide cumulative person hours of exposure to mobile source CO is shown below. The program allows the exposure concentration intervals to be changed as desired, so that the intervals shown are for example purposes and are not the only intervals possible.

```
                 POLLUTANT:  CO

    EXPOSURE TO                  PERSON
    CONCENTRATIONS               HOURS
    EXCEEDING                    EXPOSURE
    (MICROGRAM/CU.M)              (MILLIONS)
    ----------------             -----------
               0.000             1984405.260
            3500.000               82451.679
            7000.000               19394.141
           10500.000                6326.666
           14000.000                2362.171
           24500.000                 452.174
           35000.000                 166.296
           45500.000                  89.024
           56000.000                  54.733
           66500.000                  34.776
           77000.000                  22.702
           87500.000                  14.858
           98000.000                   9.499
          108500.000                   6.952
          129500.000                   4.041
          150500.000                   2.929
          192500.000                   1.539
          248500.000                    .823
          304500.000                    .382
          360500.000                    .129
          416500.000                    .010
          486500.000                   0.000
          556500.000                   0.000
          626500.000                   0.000
          696500.000                   0.000
```

I. INTRODUCTION

Internal combustion engines used in motor vehicles produce exhaust gases that contain a multitude of chemical compounds. Four of these pollutants are regulated by standards (hydrocarbons, CO, NO_x, and particulate matter). In devising means to control these four regulated pollutants, undesirable chemical compounds may inadvertently be produced or increased. Malfunction of the engine and emission control systems can also change the concentrations of the various chemical species in the exhaust. In addition, alternative fuels proposed for use in motor vehicles can produce greatly different compounds and concentrations of compounds than are currently produced by gasoline and diesel fuels. The EPA has instituted a program to determine if any of these unregulated mobile source emissions cause or contribute to a risk to public health, welfare or safety. This study is a part of that program.

Previous Work

The work reported on here is the latest in a series of projects on the subject of unregulated emissions conducted for the EPA by Southwest Research Institute. Previous projects have developed methodologies for measurement of unregulated pollutants in vehicle exhaust,(1,2,3)* determined the magnitude of many unregulated emissions in a variety of vehicles,(1,4-8) evaluated the effects of engine and emission control system malfunctions,(9-12) and measured unregulated emissions using a variety of alternative fuels.(13-17) Thus, the exhaust emission rates, in terms of mass per distance or mass per time, of many unregulated pollutants are known.

To determine effects on health and welfare, emission rates of these unregulated pollutants must be transformed into the ambient pollutant concentrations to which people are exposed. Another of the previous projects at SwRI examined localized situations heavily impacted by mobile sources in which the dispersal of mobile source pollutants is hindered, causing higher than usual concentrations.(18) Several situations involving small areas, called microenvironments, were identified. Mathematical dispersion models of these situations were selected and validated to allow the prediction of ambient concentrations in these microenvironments, based on knowledge of vehicle exhaust emission rates. These models allowed identification of areas containing highly concentrated mobile source pollution and permitted the evaluation of the health and welfare effects of short term, high level exposure to these unregulated emissions.(19)

It was not possible from that study to ascertain long term effects due to chronic exposure, such as cancer risk, for unregulated pollutants. Another project was conducted to provide annual exposure information for mobile source pollutants.(20) This information could be used to evaluate health effects of long term exposure important in performing carcinogenic risk assessments. That project used the EPA NAAQS Exposure Model (NEM) for CO, developed by the EPA Office of Air Quality Planning and Standards (OAQPS),(21) as the basis for the exposure estimate. Throughout this report whenever the words NEM or NEM computer program are used it means the actual computer code for the models as developed by OAWPS. The terms NEM study or NEM CO study refer to the study reported on in Reference 21. The NEM was not written for nationwide estimation of mobile source unregulated emissions, and its structure made it difficult to use for that purpose. Thus, while that project did provide a method for estimation of nationwide person hours of exposure to mobile source pollutants, a more refined methodology was needed. The work reported on here provides that more refined methodology.

---

*Superscript numbers in parentheses refer to references at end of this report.

The exposures calculated in this project are expressed in terms of person hours. Person hours of exposure as calculated in this project are simply the number of people in a situation multiplied by exposure time in that situation in hours. Thus, 1000 person hours of exposure can be one person exposed for 1000 hours, 1000 people exposed for one hour, or any other values of persons and hours whose product is 1000.

Objective

The objective of this project was to develop an improved methodology to obtain an estimate of nationwide, annual person hours of exposure to any mobile source pollutant. It was then to incorporate that methodology into a computer program which will calculate the person hours of exposure for any pollutant when the emission factors for that pollutant are input.

Approach

To determine the annual exposure in person hours to any mobile source pollutant, the number of persons exposed to the pollutant in various places must be known as a function of time. The ambient concentration in these places must also be known as a function of time. The exposure in person hours can then be ascertained, expressed as the number of person hours in various pollutant concentration intervals.

To determine how many people are exposed to mobile source pollutants, it is first necessary to know something about where people are during their daily activities. Obviously, all people in the United States do not follow the same daily activity pattern. Just as obvious, however, is the fact that large groups of the population do have similar activity patterns. In the previous mobile source exposure study, the NEM computer program was used to determine exposure. That program divides all the non-rural places where people can be into six "neighborhoods," with six smaller areas called microenvironments in each neighborhood. The neighborhoods were:

- Center City residential
- Center City commercial
- Center City industrial
- Suburban residential

- Suburban commercial
- Suburban industrial

These neighborhoods were chosen to match the neighborhood descriptions used in identifying EPA ambient monitor sites. The microenvironments used were:

- indoors, work or school
- indoors, home or other
- transport vehicle
- roadside
- outdoors
- kitchen

In the NEM CO study, every person in a city was assigned to a neighborhood type, and to a microenvironment in that neighborhood, for each hour of the day. Activities were simulated by changing neighborhoods and microenvironments for various hours of the day. For the purpose of neighborhood assignments, the people in each city were grouped together by age and occupation. These groupings were called A-O groups. There were 12 A-O groups, with a number of subgroups (up to six) within each main A-O group. People within the same A-O group were called cohorts.

As another part of the previous project, three important microenvironments where people are in close proximity to vehicles were identified which were not included in the NEM. These microenvironments were called mobile source microenvironments. Nationwide hourly populations for the mobile source microenvironments were determined. These mobile source microenvironments are:

- street canyons
- tunnels
- parking garages

For this study, in place of the NEM, a new exposure program was written. This new program does, however, utilize the activity patterns and A-O groups from the NEM computer program. The new procedure starts by using the NEM CO study activity patterns and cohort populations by neighborhood, to obtain the percentage of each city's population in each neighborhood/microenvironment (N/M) combination for each hour of the day. These percentages are then multiplied by the number of people nationwide, that are in cities similar to each of the four cities used. The four population distributions are summed to yield a nationwide hourly population distribution in each N/M combination. Once the nationwide population distributions are obtained, the mobile source microenvironment hourly population distributions can be subtracted from the appropriate N/M hourly population distributions. There is a different set of distributions for weekdays, Saturdays and Sundays.

Besides population in the various neighborhoods, pollutant concentration must be known to obtain person hours of exposure to various pollution levels. Pollutant concentrations vary with time in a given neighborhood. Thus, neighborhood pollutant concentrations are best expressed as frequency of occurrence distributions. However, the ambient concentrations of most unregulated pollutants are not available from direct measurements. The concentrations of these pollutants must be inferred from measurement of some other pollutant.

Nationwide, mobile sources produce approximately 76 percent of the total carbon monoxide emitted into the atmosphere.(22) For many of the microenvironments considered in this study, mobile sources are the only significant source of CO. Pollutant concentrations are linearly proportional to the exhaust emission rate ("emission factor"). More specifically, the ambient concentration of a pollutant emitted from vehicles at the rate of 4 g/min will be twice as high as the ambient concentration of a pollutant emitted at 2 g/min in the same situation. Thus, CO concentration measurements can be used to determine the concentration of any unregulated mobile source emission by multiplying the CO concentration by the ratio of the unregulated emission factor to the CO emission factor:

$$\text{Pollutant Concentration} = \text{CO concentration}\left(\frac{\text{Pollutant emission rate}}{\text{CO emission rate}}\right)$$

In this project, measured or calculated CO concentrations in each neighborhood and microenvironment were used as the indication of mobile source pollutant concentration in that neighborhood. This approach assumed that the desired pollutant and CO have equivalent dispersion and reaction characteristics in the ambient air.

Any investigation of actual pollutant concentrations in any environment reveals a rather wide range of pollutant levels. Thus, persons in these environments at different times are exposed not just to one pollutant concentration, but to a range of concentrations. The concentration level depends mainly on the number of vehicles present and the amount of ventilation (natural or artificial). The concentrations vary not only with time at a single location, but also from location to location at a given time. By accounting for the occurrence of pollutant concentration ranges for all locations of a neighborhood or microenvironment for a year, pollutant concentration frequency distributions can be developed which take into account the concentration variation with time and location.

CO distributions were obtained from different sources depending on the neighborhood or microenvironment under consideration. The CO concentration for the NEM neighborhoods were obtained from CO ambient monitor data in the EPA SAROAD data base. The street canyon mobile source microenvironment also utilized monitor data from the SAROAD data base. The CO concentrations in the tunnel and parking garage microenvironments were estimated from various studies in the literature. Prior to use in the exposure computer program, the CO concentration values were divided by the appropriate CO emission factors in grams/minute. This produced concentration distributions equivalent to those from a 1.0 g/min emission factor.

To obtain pollutant concentrations for other pollutants, the computer program multiplies the concentration distribution in the program by the new pollutant emission rate. This is simply the equation shown above rearranged as follows:

$$\text{Pollutant concentration} = \left(\frac{\text{CO concentration}}{\text{CO emission factor}}\right) \text{Pollutant emission rate}$$

The computer program then combines the hourly population values with the pollutant frequency distributions to produce cumulative exposure distributions for each N/M combination, including the mobile source microenvironments. Emission factors for the pollutant under study are required inputs for the program. Provision was made for a different emission factor for each N/M type.

Use of the Terms "Center City" and "Urban Core"

The EPA monitor site descriptions have two main classifications: center city and suburban. It is from these classifications that the NEM CO study neighborhoods were named. In this study, Census Bureau populations of "urbanized areas," which consist of a center city and some surrounding areas, are used to define the number of people in urban areas. It is most important to understand that the EPA monitor site definition of center city (from which the neighborhood type definition was taken) is not the same as the Census Bureau definition of center city used in urban population figures. The EPA publication, "AEROS Manual of Codes" defines center city as: "...core area of the city, not its incorporated limits." Conversely, the Census Bureau, in its urban population tables, defines the center city as incorporated limits. (See detailed explanation in section IV). Because of the confusion arising from having two different meanings for the term "center city," whenever possible in this report, the term "urban core" is used in place of the EPA term "center city" for neighborhood and CO monitor designations. The urban core for an urbanized area is not necessarily contiguous. Cities other than the central city of the urbanized area may have all or some of their land area devoted to "urban core" use, as may unincorporated areas within the urbanized area. The exact meaning of "urban core" is developed operationally in later sections. For the present, only a conceptual understanding is needed.

Report Organization

In the report sections that follow, the information necessary to produce both the pollutant distributions by N/M types, and the population distributions by N/M type, is presented in detail. The pollutant concentration distribution development is presented first because, in the case of the street canyon mobile source microenvironment, the CO concentration is used to help define the street canyon population distribution.

For both the pollutant and population distributions, the information on the general NEM type neighborhoods is presented first, then the information on the three mobile source microenvironments. The next-to-last section of the report explains the exposure estimation computer program and its use.

II. NEM N/M POLLUTANT CONCENTRATIONS

The basic premise of this study is that measured (or calculated) CO concentrations in various environments can be used to calculate the concentrations of any mobile source-generated pollutant by knowing the relative emission factor of CO and the pollutant of interest. The previous SwRI project to estimate exposure to mobile source pollutants utilized the NEM CO study. The NEM CO study was for four cities. There were six neighborhood types used by the NEM, with one CO monitor representing each neighborhood type in each city. Because of the difficulty in locating suitable CO monitors, some monitors represented more than one neighborhood type. Thus, in the NEM CO study, only 20 CO monitors were used to represent all four cities, and by extrapolation, the entire country.

This project sought to increase the number of CO monitors used, by selecting from the EPA SAROAD data base CO monitors by neighborhood type from the whole country. The selection criteria for the CO monitors were:

- Sufficient data (60% of possible hourly readings = 6100 hours)
- Not a microscale monitor, such as a street canyon monitor
- Representative of mobile source pollution (i.e., no large stationary sources close by)
- Cross section of range of CO concentrations encountered

Calendar year 1981 CO monitor data were chosen for use, to be compatible with the 1981 street canyon CO concentration distribution generated in the previous exposure study.

EPA provided a 1981 list of SAROAD station descriptions (on microfiche) and a printed summary report of 1981 through 1983 CO concentration statistics from CO monitors in the SAROAD data base. There were 346 CO monitors in the 116 largest urban areas with 1981 CO readings. The site descriptions were read from the microfiche to obtain the descriptions of these 346 monitors. The site descriptions and statistics were combined and sorted by N/M type. Of the 346 CO monitors, 68 monitors had less than 6100 hours of data. Of the remaining 278 monitors, no description was available for 7 monitors, and 12 monitors had no neighborhood type listed. From this list a total of 99 monitors were selected for use in this study. The final monitor selection was made after consultation with EPA.

A summary of the characteristics of the 99 monitors chosen is presented in Table II-1. The individual monitors selected are listed by neighborhood type in Appendix A. An attempt was made to have at least 20 monitors for each neighborhood type. Unfortunately, for the industrial neighborhoods, both urban core and suburban, only 8 monitors were available. Based on the four selection criteria listed above, all of the data were screened as follows:

- Sufficient data - All monitors chosen had 6100 or more hours of hourly CO readings in 1981, except for two urban industrial and three suburban industrial monitors which were included to provide larger industrial neighborhood data bases. It should be noted that values were not assumed for missing readings. The frequency distributions were developed from the measured data.

- Not a microscale monitor - Monitors were checked against a list of street canyon monitors provided by EPA, OAQPS, in a previous project. Many of the originally selected urban core-commercial monitors were street canyon monitors, and so were removed from the list. Any monitor whose description included the comment that it was a microscale monitor was not considered.

- Representative of mobile source pollution - National Air Monitoring Site (NAMS) and State and Local Air Monitoring Site (SLAMS) monitors were used as much as possible. According to EPA, OAQPS, the siting criteria for NAM and SLAM monitors require that they not be influenced by nearby point sources. This was the only check used for representativeness of the monitors. No site visits were made.

- Cross section of CO concentration - As can be seen from the listings and the summary, there is a wide range of CO values, from a large number of cities in different geographical areas. The monitors chosen include the monitor that had the highest one hour reading in 1981 (67.5 in Denver).

TABLE II-1. SUMMARY OF CO MONITORS SELECTED FOR MOBILE SOURCE EXPOSURE ESTIMATE

- 99 CO monitors were selected from 346 CO monitors with 1981 data.

- 42 monitors were National Air Monitoring sites, 31 monitors were State and Local Air Monitoring sites.

- 56 of the 116 urban areas with population about 200,000 are represented.

- 29 of 41 states with urban areas over 200,000 population are represented.

- The monitor with the highest one hour CO reading in 1981 is included (67.5 mg/m^3 in Denver).

- Summary by neighborhood type in order of decreasing median value:

	Monitor Maximum 1 hr CO. mg/m^3			No. of Monitors
	Max.	Min.	Median	
Urban core-commercial	67.5	12.5	21.3	22
Urban core-residential	33.4	11.0	17.3	21
Suburban-commercial	33.4	8.1	17.0	20
Suburban-residential	32.2	9.2	16.5	20
Urban core-industrial	22.4	8.6	14.4	8
Suburban-industrial	28.8	7.0	11.1	8

The hourly readings for the year 1981 from these monitors were requested from the EPA National Air Data Branch (NADB). When received, the hourly CO data from each of the 99 monitors were edited using a SwRI editing program developed in a previous project and described in more detail in Section III, to produce a set of data that could be used with the SPSS statistical computer program. After the editing procedure was completed, the hourly CO data from the different monitors were aggregated for each neighborhood type by the SPSS program to produce summary statistics and hourly concentration frequency of occurrence distributions for each neighborhood. The descriptive statistics are shown in Appendix A. Different distributions were produced for weekdays, Saturdays and Sundays.

To keep the distributions to a reasonable number, within each day and neighborhood type; similar hourly distributions were combined to produce six distributions for each day type, in each neighborhood. This procedure produced a total of 108 distributions. Finally, the CO intervals for these distributions were converted to values, in micrograms per cubic meter, representing a one gram per minute emission factor. This change was accomplished by converting the PPM values to $\mu g/m^3$, then dividing by an appropriate 1981 CO emission factor in grams/minute for each neighborhood and day type. Grams per minute were chosen as the units for emission factors to allow the use of idle emission factors where needed.

The 1981 CO emission factors in g/mile were provided by Rob Bruetsch, the EPA Branch Technical Representative for this project, from a computer run of the EPA MOBILE3 computer program. These factors were converted to g/min by using the average cycle speed for use with this project. The description of the emission factor used for each neighborhood and day type, together with its numerical value in grams per mile and grams per minute, are shown in Table II-2. The final frequency distributions are listed in Appendix A. These NEM neighborhood pollutant concentration distributions, together with the mobile source microenvironment pollutant concentrations presented in the next section, constitute the pollutant concentration frequency distribution inputs to the person hour exposure computer program.

TABLE II-2. 1981 CO EMISSION FACTORS USED FOR EACH NEIGHBORHOOD

Neighborhood	Emission Factor Description	MOBILE 3 1981 CO Value g/mile	Weekday g/min	Saturday & Sunday g/min[a]
Urban Core Residential	FTP	49.01	16.01	11.53
Urban Core Commercial	10 mph	90.31	15.05	10.84
Urban Core Industrial	10 mph	90.31	15.05	10.84
Suburban Residential	FTP	49.01	16.01	11.53
Suburban Commercial	FTP	49.01	16.01	11.53
Suburban Industrial	FTP	49.01	16.01	11.53

---

[a] Because actual measured Saturday and Sunday CO distributions were used for the six NEM neighborhoods, a different weekend emission factor was used to account for the different weekend traffic mix. This factor is 72 percent of the weekday factor. See Section V.

NEM Microenvironments

Within the NEM computer program, the measured neighborhood monitor concentration values are modified to allow for different concentrations within each microenvironment in a neighborhood. While the NEM CO study used six microenvironments, these were combined to produce four microenvironments for use in this study. They were:

- indoors (includes work indoors, home indoors, and kitchen from NEM CO study)
- transport vehicle
- roadside
- outdoors

Note that the NEM microenvironments for work indoors, home indoors and kitchens are combined as one indoor microenvironment for this study.

The NEM technique for modifying the neighborhood monitor concentration to produce microenvironment concentrations was to develop a different scaling factor (multiplier) for the hourly monitor concentration readings for each microenvironment. The NEM CO study examined 75 reports of studies of CO concentrations in the various microenvironments. As a result of this examination, a range of ambient monitor scaling factors was developed for each microenvironment. One value of the scaling factor was chosen as a best estimate.(21) These best estimates, shown in Table II-3, were used in this project's exposure computer program as the NEM microenvironment scaling factors to be applied to the neighborhood CO concentrations. For a detailed discussion of these microenvironments and how the scaling factors were obtained, see Chapter 6 of Reference 21.

TABLE II-3. BEST ESTIMATE OF CO SCALING FACTOR FOR NEM MICROENVIRONMENTS

Microenvironment	Ambient CO Scaling Factor
Indoors	0.85
Transport Vehicle	2.10
Roadside	1.20
Outdoors	0.95

Of the microenvironments listed in Table II-3, only two transport vehicle and roadside, are heavily impacted by mobile sources. Reference 21 indicates that the "transport vehicle" CO data was intended to represent both cars and trains, with rush hour traffic constituting much of the data examined. Several studies have indicated that exposure concentrations from mobile sources do not correlate well with fixed site monitors. This study was conducted to specifically evaluate mobile source exposure. It was apparent that additional microenvironments, specific to mobile sources, needed to be examined and concentrations for these microenvironments be determined independent of fixed site monitor values. Thus, it was necessary to define several new mobile source microenvironments, independent of NEM neighborhoods. The emission concentrations of these neighborhoods are defined in Report Section III and V.

III. MOBILE SOURCE MICROENVIRONMENT POLLUTANT CONCENTRATIONS

In the previous SwRI exposure study, three microenvironments were identified that can have high pollutant concentrations as a result of mobile sources. In this study these areas are called mobile source microenvironments. The three mobile source microenvironments are:

- Street canyons
- Tunnels
- Parking garages

These are not the only microenvironments where mobile sources have an impact. However, within the effort allotted for this study, they were the microenvironments for which information was most available. One important mobile source micorenvironment that was not considered separately was the on-expressway microenvironment. The exposure of a commuter on an expressway during rush hour is a significnat mobile source exposure. While it is not covered as a separate microenvironment, it is covered by the "transport vehicle" microenvironment in the NEM. An examination of the NEM activity patterns show that much of the exposure occurs during rush hour. The NEM "transport vehicle" microenvironment scaling factor (Table II-3) was developed for predominately congested expressway CO measurements. Thus, the on-expressway mobile source microenvironments can be considered to be accounted for in the NEM "transport vehicle" microenvironment.

Only for street canyons was a large amount of measured CO concentration data available. For the other two mobile source microenvironments, some method of estimating the frequency distribution of pollutant concentration values was required. From an examination of a number of individual studies of each microenvironment, an estimate of the average concentration and range of concentrations within that microenvironment can be determined. For any distribution, if an assumption is made about the shape of the distribution, then a mathematical description of that distribution can be obtained.

The Lognormal Distribution

The lognormal distribution has been used for about 15 years to describe the distribution of ambient pollutant measurements both with time and location.(23-25) The lognormal distribution gets its name from the fact that the logarithms of the independent variable are normally distributed. Over the years, a lively debate has been conducted in the literature on whether the lognormal distribution was the best representation of the concentration distribution. While other distributions, such as the Weibull distribution, have been suggested,(26) the lognormal appears to be the most widely used. For this study, the lognormal distribution has the additional virtue of being definable from available concentration values. Therefore, the lognormal distribution was chosen as the mathematical form to use when there were insufficient data to determine the distribution experimentally from measured values.

Preceding page blank

The expression for the two-parameter lognormal distribution is:(27)

$$dF(x) = \frac{1}{\sigma x \sqrt{2 \pi}} \quad \exp \left[\frac{1}{2 \sigma^2} \quad (\ln x - \mu)^2 \right] \quad dx$$

where:

x = dependent variable
μ = ln (mediam)
$\sigma = \sqrt{\ln (\text{mode}) - \mu}$

The distribution can be completely defined if μ and σ are known. Appendix B presents the various mathematical relationships between μ and σ and the mean, median, mode, and range that are required to define lognormal distributions when either the median and mode or the range and the mean are known. Thus, for cases where there is insufficient data to define a concentration distribution experimentally, a concentration distribution will be defined using values for the median and mode or range and mean that are estimated from available literature studies.

Parking Garage Pollutant Concentrations

The first microenvironment for which ambient air concentrations of pollutants were developed was the parking garage. While CO concentrations in parking garages have been a concern for years, few quantitative data are available. The data available are often only a maximum CO or average CO concentration. These values are not sufficient for this project. A distribution of concentrations is needed, since using an average concentration would eliminate any high-level exposures. However, there was not sufficient information in the literature to determine this distribution. Table III-1 is a list of measured parking garage CO concentrations found in the literature. The modeling study done under Contract 68-03-2884 also calculated a CO concentration of 37 ppm in a "typical" (mode average) garage and 374 ppm for a "severe case" parking garage. These CO values all indicate that pollutant concentrations are not normally distributed, but rather are skewed to the right, with a long "tail" at the higher concentrations.

Since adequate data to define the distribution do not exist, it was decided to choose a distribution equation, then use the CO values for the typical and severe parking garage from Contract 68-03-2884 to define the distribution. The concentration distribution is then in a mathematical form which could easily be modified if measured data become available in the future. As explained earlier, the lognormal distribution was chosen to represent the pollutant concentration distributions where there were insufficient data to define the distribution experimentally. As shown in Appendix B, a lognormal distribution can be completely defined if the median and mode of the distribution are known.

TABLE III-1. CO LEVELS FOUND IN PARKING GARAGES

CO Levels	Reference No.	Study Location	Study Date
20 ppm to over 100 ppm (off scale 100). Several peaks appear as though they would exceed 150 ppm	28	Detroit	1961
0-200 ppm Car Park A (Sat.) 0-20 ppm Car Park A (Tues.) 0-200 ppm Car Park B1 0-30 ppm Car Park B2 33 ppm @ 200 car/hr Car Park B4 Max. 110-130 ppm Car Park C1 50 ppm Car Park C2 105 ppm Car Park D1 Max. 400-450 ppm Car Park D2 (mech. vent.)	29	England	1976
30-87 ppm eight hr avg	30	Philadelphia	1977
peaks often above 200 ppm max 365 ppm	31	Los Angeles	1975

For this project, the typical garage CO value developed under a previous project(18) was used as the mode. The median was adjusted so that the frequency of occurrence in the "severe" concentration range was approximately equal to one garage. Assuming 10,000 parking garages in the country, this is equivalent to a frequency of occurrence of 0.01 percent.

A distribution in ppm CO, using the calculated typical and severe levels, was first computed since ppm is a more familiar unit for CO, and for comparison to the data in Table III-1. The mode was taken as 37 ppm(18) and the median adjusted until the frequency of occurrence in the 300 to 400 ppm interval was approximately 0.01 percent. This process resulted in a median value of 48 ppm. The resulting distribution is shown in Figure III-1. Note that the largest number of occurrences are in the range of the CO values shown in Table III-1.

This study required ambient concentrations in $\mu g/m^3$ based on a 1.0 g/min emission rate. The typical concentrations obtained from the modeling work done under Contract 68-03-2884 were actually calculated using a one gram per minute emission factor. The typical garage has an ambient air level of 3900 $\mu g/m^3$ for 1.0 g/min pollutant emission rate; the severe garage, a level of 46,000 $\mu g/m^3$.(18) For both these situations, the active cars represented 25 percent of parking capacity. For this distribution, the mode was taken as 3900 micrograms/m^3 and the median 5500 micrograms/m^3. Using this mean and mode, and the calculations in Appendix B for lognormal distributions, a μ of 8.6125 and a σ of 0.58632 was obtained.

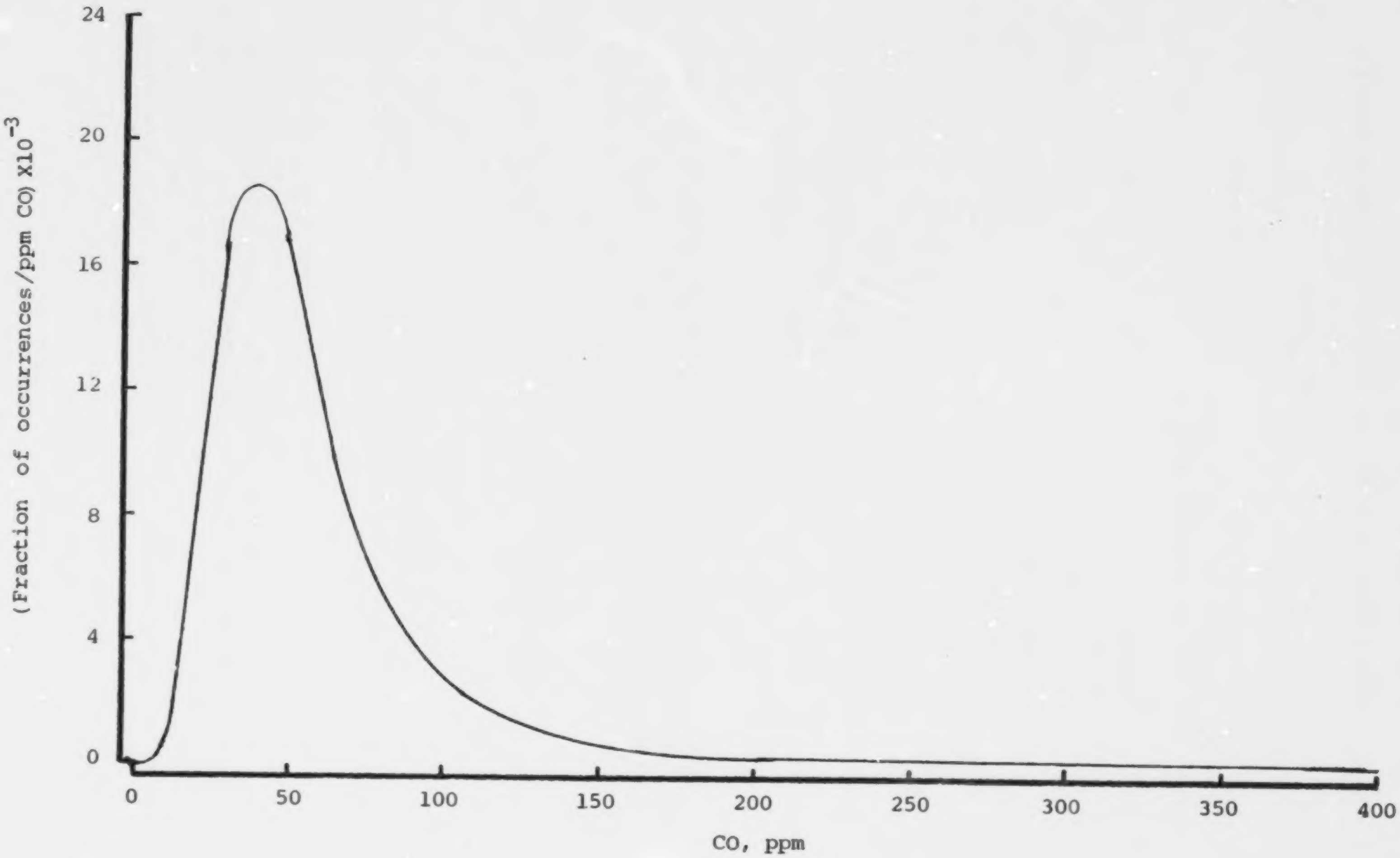

Figure III-1. Parking garage CO concentration distribution, 25 percent active cars, average wind speed

The model used for parking garage ambient concentrations in a previous EPA study(18) indicates that after a short period, generally less than 10 minutes, the concentrations are essentially proportional to the number of cars divided by the effective ventilation rate. Thus, concentrations will vary with number of active cars. The active cars per hour vary from 0 to 21.3 percent of parking capacity (See Section V). However, except for the times a parking garage is filling or emptying in connection with a specific event, the cars active at any instant are generally less two percent. To account for the more active times (such as before and after working hours for garages serving office buildings) as well as the usual level of activity, it was decided to use two levels of activity: Three percent and 19 percent active cars. The three percent active cars would be used to represent normal activity. The 19 percent active cars would be used to represent congestion associated with single events (concerts, sporting events, parades, etc.). These distributions were developed by scaling the 25 percent mode and median by the ratio of active cars to 25 percent active cars, since concentration varies linearly with number of cars.

As mentioned above, pollutant concentration varies not only with number of active cars, but also with effective ventilation rate. The $\mu g/m^3$ pollutant levels for the typical garage were calculated assuming a naturally ventilated garage with an "average" value for wind speed. All underground parking garages are mechanically ventilated, so the ninety percent of garages in the country that are naturally ventilated(18) are all above ground with ventilation rate depending on wind speed. Since the person hour exposure for this study is to be for an entire year, the ventilation rate can be expected to vary during the year as wind speed varies. It has been shown in a number of studies that wind speed at a given measuring station varies lognormally.(32)

To obtain an estimate of how wind speed varies through the country, the annual wind speed distributions for seven cities were averaged. The wind speed distributions for each city were obtained from the NOAA publication "Airport Climatological Summary."(33) The average of the seven distributions is shown in Figure III-2. Note that approximately 65 percent of the time the average wind speed is between 4 and 10 knots, 25.5 percent of the time it is between 11 and 27 knots, and 9.5 percent of the time it is 3 knots or less.

The pollutant distributions above were calculated using approximately a seven knot wind speed for the typical (mode) garage. To account for the concentration variation with wind speed, two other wind speeds (1.5 knots and 14 knots, the medians of the upper and lower wind speed intervals used) were chosen to represent ventilation rates lower and higher than the mode. Pollutant concentration distributions were calculated using three wind speeds by multiplying the mean and mode of each of the three distributions calculated at 7 knots by the ratio 7.0/new wind speed, since pollutant concentration is inversely proportional to ventilation rate.

These calculations resulted in six pollutant distributions; three distributions depending on ventilation rate for each of two levels of active cars. The mode, median, and of each of the distributions are shown in Table III-2.

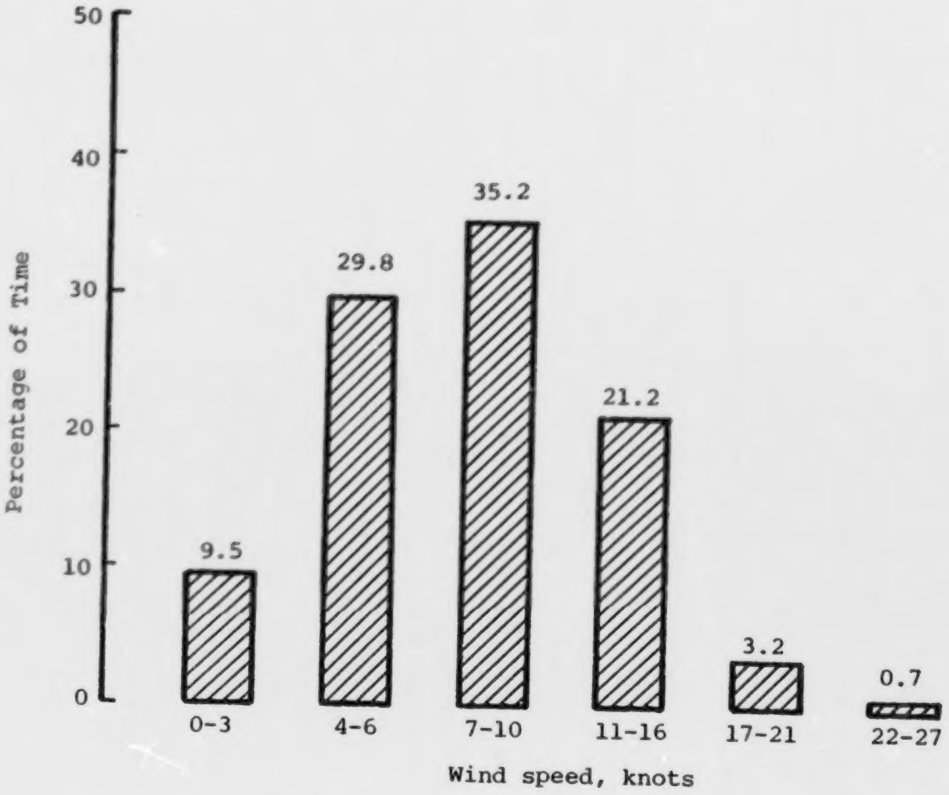

Figure III-2. Wind speed distribution, average of seven U.S. cities

TABLE III-2. PROBABILITY DISTRIBUTION PARAMETERS FOR PARKING GARAGE POLLUTANT DISTRIBUTIONS

Percent Active Cars	Wind Speed, Knots	Probability Distribution Parameters, g/m^3			
		Mode	Median	μ	σ
19	1.5	14000	19500	9.8782	0.5756
	7	3000	4200	8.3428	0.5801
	14	1500	2100	7,6496	0.5801
3	1.5	2200	3000	8.0064	0.5569
	7	470	660	6.4922	0.5827
	14	235	330	5.7991	0.5827

The continuous pollutant distributions generated must be converted into discrete distributions to use in the person hour exposure computer program. A computer program was written to evaluate the expression for the lognormal distribution, producing frequencies of occurrence for each pollutant interval using arbitrarily chosen pollutant intervals.

Note that the pollutant concentration frequency distributions developed so far for parking garages are in terms of percent traffic and wind speed. The computer program developed for this project to calculate person hours of exposure evaluates exposure by hour of the day. Thus, the parking garage pollutant frequency distributions must be converted into a format that can be chosen by hour of the day. The computer program is also structured to allow only one pollutant distribution to be used for each hour. The three distributions for each traffic level, resulting from consideration of wind speed, were combined into a single distribution for each traffic level by weighting the frequencies of each wind speed distribution by the percent occurrence of that wind speed interval, then summing the weighted frequencies.

Parking garages serve a variety of activities. While some parking garages are subjected to congestion regularly, others are never congested. In a previous project it was estimated that for all parking garages, only about 25 percent are regularly subjected to congested conditions, and these conditions occur only one or two hours per day. Since the computer program allows for only one frequency distribution for any hour, a composite frequency distribution was developed to account for congested groups. This composite distribution was calculated by weighting the frequencies for the three-percent-active-car distribution by 75 percent and the 19-percent-active-car distribution by 25 percent, then summing the weighted frequencies for each concentration interval.

Since three percent active cars represents the normal activity, the three percent distributions are used for all but two hours of the day on weekdays and one hour on Saturdays. During the weekdays, congestion in parking garages will occur most often at the morning and evening rush hours as people are going to and leaving work. Thus, for weekdays, the composite concentration distribution was used for the 7 to 8 A.M. and 5 to 6 P.M. hours. For Saturday, the composite distribution was used for the 10 to 11 P.M. hour to account for congestion from a specific event. The final two pollutant concentration distributions used for parking garage exposure are listed in Table III-3.

TABLE III-3. FINAL PARKING GARAGE POLLUTANT CONCENTRATION DISTRIBUTION

$\mu g/m^3$ Concentration[a]	Frequency for Percent Active Cars	
	3 Percent	Composite
0	0.2410	0.1810
360	0.1180	0.0887
463	0.1520	0.1149
618	0.1150	0.0880
773	0.1240	0.0982
1030	0.0710	0.0385
1288	0.0410	0.0405
1546	0.0260	0.0305
1804	0.0180	0.0252
2061	0.0130	0.0221
2319	0.0110	0.0203
2577	0.0130	0.0287
3000	0.0220	0.0553
4000	0.0120	0.0380
5000	0.0070	0.0259
6000	0.0070	0.0301
8000	0.0020	0.0142
10000	0.0010	0.0110
15000	0.0000	0.0064
20000	0.0000	0.0038
25000	0.0000	0.0021
30000	0.0000	0.0009
35000	0.0000	0.0000
40000	0.0000	0.0000
50000	0.0000	0.0000

---

[a] for a 1 g/minute emission factor

Urban Commuter Tunnel Pollutant Concentrations

The literature on air pollution in urban commuter tunnels had been extensively investigated under a previous EPA study(18). While CO is monitored in almost all mechanically ventilated tunnels, there are few published CO data. A list of the information found is presented in Table III-4. The most complete study found was in Reference 34, which had detailed CO levels for the Sumner Tunnel in Boston. From the information presented on the Sumner Tunnel in Reference 34, plots of both average and maximum CO levels as functions of percent of average daily traffic (ADT) per hour for weekdays were developed. These plots are shown in Figure III-3.

TABLE III-4. CO LEVELS FOUND IN URBAN COMMUTER TUNNELS

CO Concentrations	Reference No.	Study Location	Study Date
110 ppm (7:30-8:00 A.M., No. Tube) 190 ppm (7:30-8:00 A.M., So. Tube)	34	Squirrel Hill Tunnel Pittsburgh, PA	1969
140 ppm (5:30-5:45 P.M., West Tube)	34	Liberty Tunnel Pittsburgh, PA	1969
75 ppm (avg over 3 days) rarely exceeded 180 ppm	34	Baltimore Harbor Tunnel Baltimore, MD	1971
12-144 ppm mean 30-238 ppm peak	34	Sumner Tunnel Boston, MA	1961
40-200 ppm (North Tube) 10-60 ppm (Center Tube)	34	Lincoln Tunnel New York, NY	est. 1970
10-100 ppm avg (West Tube) 250 max	34	Fort Pitt Tunnel Pittsburgh, PA	1971
40-250 ppm	34	Armstrong Tunnel Pittsburgh, PA	1971
42-122 ppm (Brooklyn Bound Tube)	35	Brooklyn Battery Tunnel New York, NY	1971

All tunnels have ventilation systems designed for some maximum CO rate at the maximum expected traffic levels. This means that for all tunnels, the CO relationship with percent of average daily traffic (ADT) should be similar. The maximum design CO level has generally been in the 200 to 250 ppm CO range. Maximum hourly traffic is rarely over eight percent of ADT. Thus, the Sumner Tunnel data can be used as the basis for development of pollutant concentration distributions for roadway tunnels.

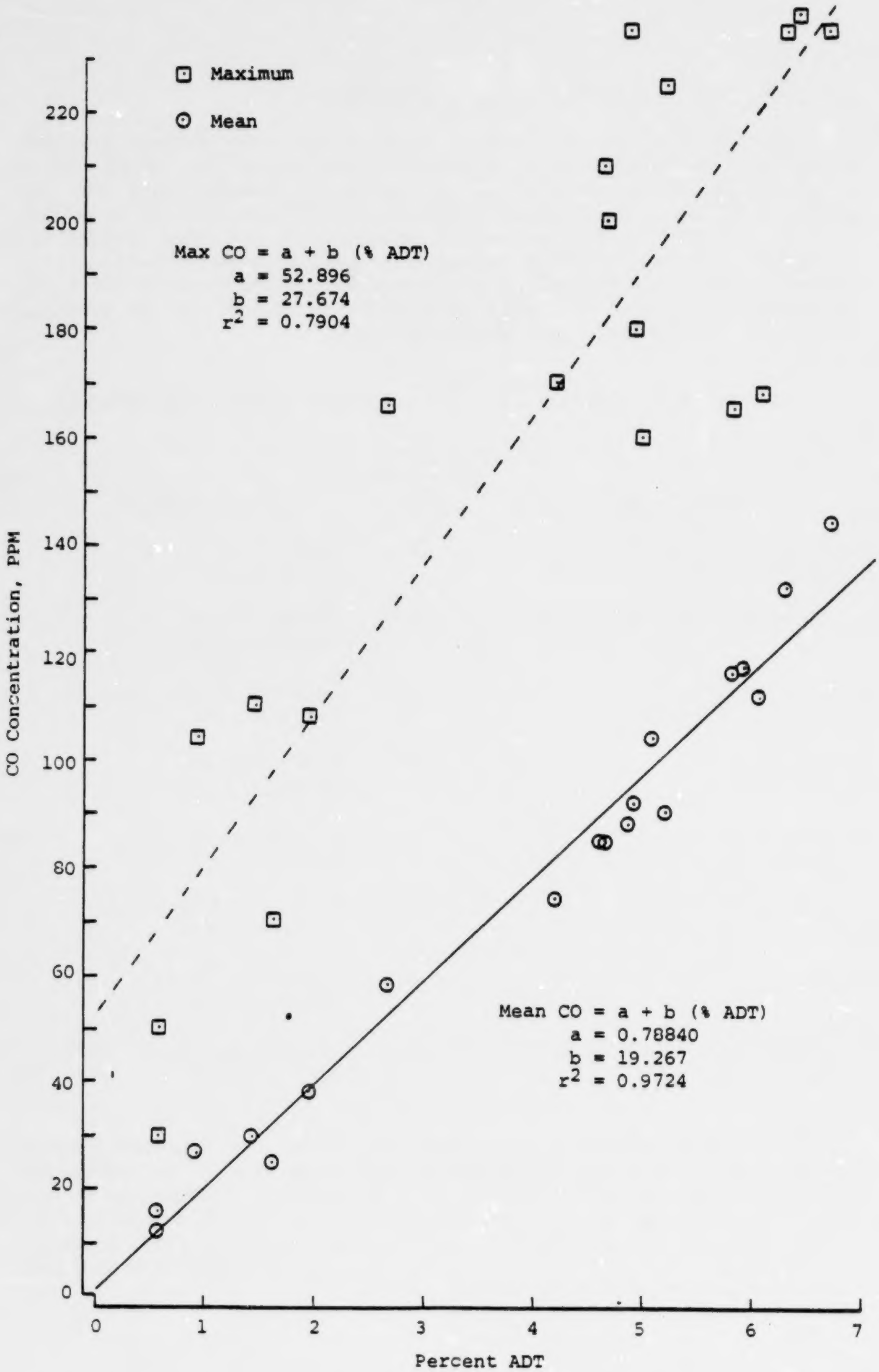

Figure III-3. CO concentration as a function of hourly percent ADT for the Sumner Tunnel (1961)

A linear regression was performed on the average CO concentrations and the percent ADT values shown in Figure III-3. The results of that analysis are shown on the figure, together with the results of the regression analysis of the maximum values. As might be expected, the maximum CO values did not produce as good a linear fit as the mean CO values. The mean CO level is obviously a function of the percent ADT.

If the pollutant concentration is assumed to be lognormally distributed for a given percent ADT as a result of tunnel-to-tunnel variability, fleet composition, weather and traffic flow variability; then with the mean concentration taken as the distribution mean and the maximum concentration as an indication of the range, the distributions for all tunnels could be defined from the data on hand. However, from a summary of tunnel ventilation in Reference 18, the Sumner Tunnel appears to have a worse than average ventilation rate in terms of cubic meters per meter of lane, while having higher than average ADT. Thus, the Sumner Tunnel is likely to have higher CO levels than an average tunnel.

The Sumner Tunnel ventilation rate is approximately 25 percent less than the average rate. This factor can be taken into account by reducing the mean CO value shown in Figure III-3 by 25 percent at a given percent ADT. The maximum values will not be changed, since they are values that are found in tunnels and must be included in the distribution. The ADT in the Sumner Tunnel is approximately 1.6 times higher than the mean ADT for all tunnels.(18,19) To account for this difference, the percent ADT can be increased 1.6 times for a given CO concentration. Again the maximum values are not adjusted. When these two adjustments are made, the relationships between hourly percent ADT and CO concentrations for an average tunnel are as shown in Figure III-4.

Assuming that the CO concentration in tunnels has a lognormal distribution with respect to time, the CO distribution can be determined from the mean and maximum CO values at any percent ADT. See Appendix B for the method used to obtain these distributions. CO distributions were determined for roadway tunnels at one percent ADT intervals starting with 0.5 percent ADT and ending at 6.5 percent ADT. The equations obtained from the calculations in Appendix B are continuous ppm CO distributions. This project required discrete distributions in terms of $\mu g/m^3$ for a 1.0 g/min emission factor. However, it is also desirable to have the discrete distributions in terms of ppm CO for comparison with measured data.

To convert from ppm CO to $\mu g/m^3$ at 1.0 g/min, the emission factor for vehicles in tunnels is required. The Sumner Tunnel data were taken in 1961. Therefore, a 1961 CO emission factor should be used to convert the data in Figure III-4 to a 1.0 g/min emission factor. A national average fleet emission factor for 1961 is not available from published EPA emission factors. To obtain the 1961 emission factor, Ms. Lois Platte at the EPA Mobile Source Laboratory in Ann Arbor, Michigan was contacted. At her direction, the EPA emission factor computer program MOBILE2 was run to generate a 1961 national fleet CO emission at 35 mph. The resulting emission factor was 62.06 g/mile, which converts to 36.2 g/min at 35 mph. The conversion factor for ppm CO at 36.2 g/min to $\mu g/m^3$ at 1.0 g/min is: 1157/36.2 = 31.96.

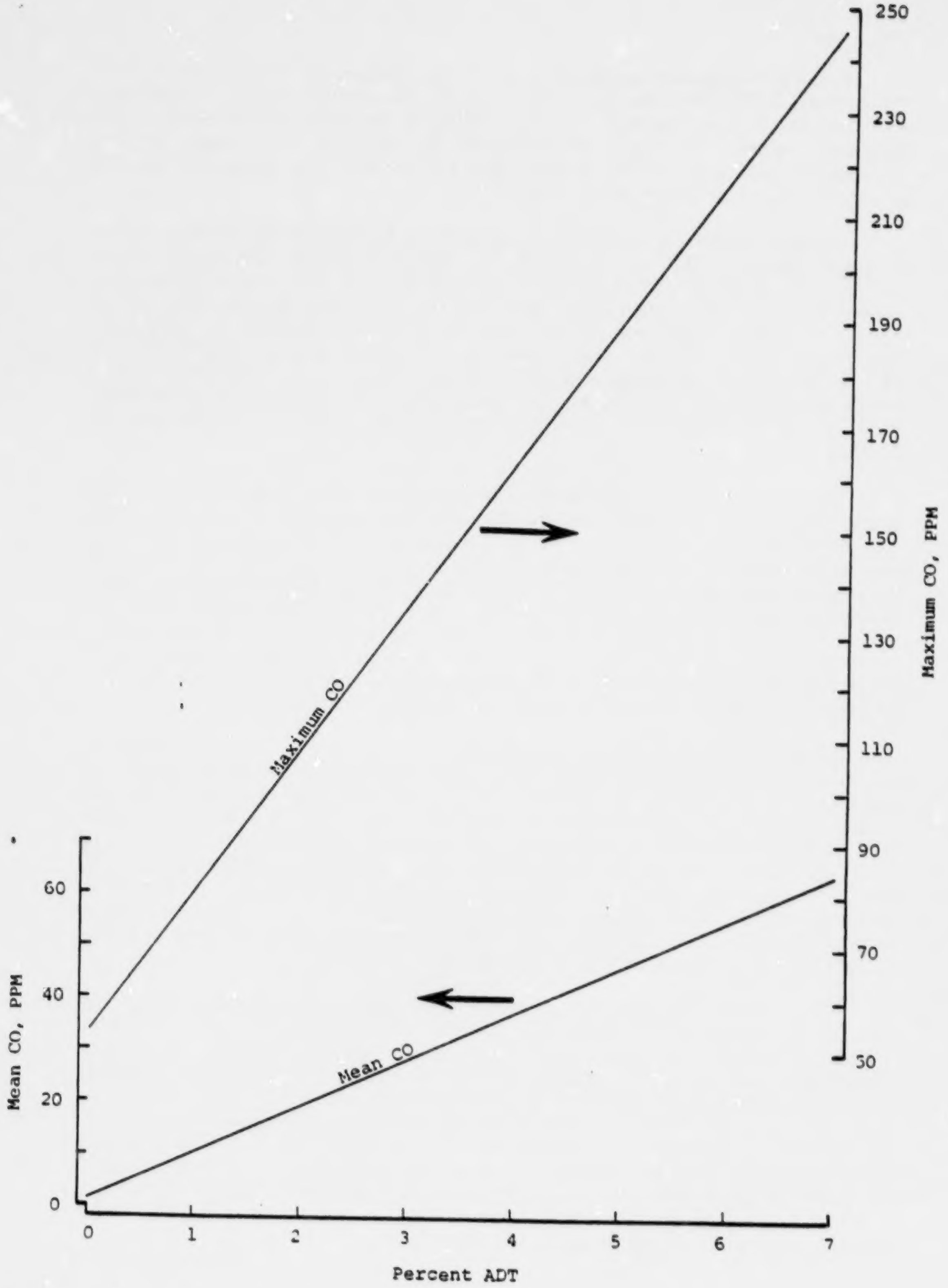

Figure III-4. CO concentration as a function of Hourly Percent ADT for an average Roadway Tunnel

The concentration intervals are shown in Table III-5. The discrete pollutant distributions in terms of ppm CO are shown in Table III-6 for various levels of hourly percent ADT. These distributions, with the $\mu g/m^3$ interval values replacing the ppm CO values, were used in the person hour exposure computer program. The distributions were selected by hour of the day using the "percent ADT by hour of the day" relationships developed in Section V.

Street Canyon Pollutant Concentration

The street canyon exposure calculated in this project is for people outside on the sidewalk or in vehicles in the street canyons. It does not include people in buildings adjacent to the street canyons. Unlike parking garages, where there have been few measurements of vehicle pollutant levels, CO samples have been taken in downtown street canyons by fixed monitors for a number of years. The National Air Data Branch of the EPA was contacted regarding the information that could be retrieved from the data bank of monitor readings using the SAROAD system. From the information received, it appeared that there was the potential for obtaining a great deal of information regarding CO levels in street canyons. However, the data that were easily available were not sufficient for the needs of the project. Since the raw data for CO is stored by hour of the day, it is possible to get summaries of specific monitors by hour of the day for each month of the year. These data could be used to obtain frequency distributions for weekdays, Saturday and Sundays.

To use the stored monitor data, it was necessary to know which monitors are in street canyons close to street level. There are currently over 4000 active sites, which makes it a time-consuming task to locate CDB sites manually. Discussions with personnel in EPA's Office of Air Quality Planning and Standards led to the EPA group that is charged with inspection of all monitors that are part of the National Air Monitoring (NAM) network. This group was able to furnish a list of central city monitors which are known to be in street canyons. The list is contained in Table III-7. From this list, data was obtained for 23 street canyon monitors. These monitors had been specifically excluded from the monitors used to develop CO concentrations in the NEM neighborhoods. Thus, a total of 122 (99 plus 23) CO monitors were used to develop the CO concentrations for this study.

The purpose in obtaining these data was to provide as large a measured CO base as possible from which to generate a street canyon pollutant frequency distribution. Data from all the cities were merged in one set of CO readings regardless of city size or other variables. The time and effort allotted to this project were not sufficient to weight the individual monitor values by city size, street size, or traffic density, or to compare individual monitor distributions.

The data, as received, were formatted to have 12 hours of data from one station on each line. This arrangement means that one day's data from one station required two lines. If all 12 hours of data were missing, the whole line was skipped. Thus, some days had two lines of data and some had only one line. The statistical computer program used to analyze the information (Statistical Package for the Social Sciences, SPSS) could not handle this type of variable format. The data from the monitoring stations were also not all in the same units. Some data were in ppm and some in milligrams per cubic meter. The readings themselves consisted of four integers, with the decimal point location

TABLE III-5. POLLUTANT CONCENTRATION INTERVALS FOR ROADWAY TUNNELS

PPM CO	$\mu g/m^3$ at 1.0 g/min[a]
0	0
6.26	200
12.52	400
18.77	600
21.90	700
25.03	800
28.16	900
31.29	1000
37.55	1200
43.80	1400
50.06	1600
56.32	1800
62.58	2000
68.83	2200
75.09	2400
81.35	2600
93.86	3000
125.15	4000
187.73	6000
250.30	8000

---

[a] Based on a 1961 CO emission factor of 62.06 g/mile at 35 mph. This is equivlaent to 36.20 g/min. One ppm CO = 1157 $\mu g/m^3$ CO.

TABLE III-6. DISTRIBUTIONS OF HOURLY AVERAGE CO LEVELS IN ROADWAY TUNNELS

PPM CO Interval	Frequency for Percent ADT Shown						
	0.5	1.5	2.5	3.5	4.5	5.5	6.5
0-6.26	0.777	0.288	0.067	0.013	0.006	0.001	0.000
2.26-12.52	0.129	0.317	0.230	0.109	0.045	0.018	0.007
12.52-18.77	0.044	0.169	0.218	0.175	0.105	0.057	0.030
18.77-21.90	0.011	0.052	0.086	0.088	0.068	0.045	0.027
21.90-25.03	0.008	0.038	0.071	0.081	0.071	0.052	0.035
25.03-28.16	0.006	0.029	0.058	0.073	0.071	0.057	0.042
28.16-31.29	0.004	0.022	0.047	0.065	0.068	0.059	0.047
31.29-37.55	0.006	0.030	0.069	0.105	0.120	0.116	0.100
37.55-43.80	0.004	0.019	0.046	0.077	0.099	0.107	0.102
43.80-50.06	0.003	0.012	0.032	0.056	0.078	0.092	0.095
50.06-56.32	0.002	0.008	0.022	0.041	0.061	0.077	0.085
56.32-62.58	0.001	0.005	0.015	0.030	0.047	0.063	0.074
62.58-68.83	0.001	0.004	0.011	0.022	0.036	0.051	0.062
68.83-75.09	0.001	0.003	0.008	0.016	0.028	0.041	0.052
75.09-81.35	0.001	0.002	0.006	0.012	0.021	0.033	0.043
81.35-93.86	0.001	0.003	0.007	0.016	0.029	0.047	0.065
93.86-125.15	0.001	0.003	0.008	0.019	0.033	0.057	0.085
125.15-187.73	0.001	0.001	0.004	0.009	0.019	0.035	0.056
187.73-250.30	0.000	0.000	0.001	0.001	0.002	0.005	0.009

TABLE III-7. SAROAD CO MONITORS USED IN STREET CANYON ANALYSIS

SAROAD No.	Hourly Readings Available[a]	State	City
10 1960 085H01	7848	FL	Jacksonville
10 2700 018G01	8144	FL	Miami
10 4360 056G01	7782	FL	Tampa
11 0200 043F01	6309	GA	Atlanta
14 1220 040F01	7616	IL	Chicago
15 2040 034F01	7912	IN	Indianapolis
18 2380 026G01	7782	KY	Louisville
19 2020 017F01	5814	LA	New Orleans
21 0120 034H02	7768	MD	Baltimore
22 0240 022F01	6512	MA	Boston
22 2160 007F01	1084	MA	Springfield
23 1180 021G01	8030	MI	Detroit
33 4680 058F01	8090	NY	New York
33 4680 062F01	8023	NY	New York
34 0700 029G01	8002	NC	Charlotte
36 1220 021G01	7945	OH	Cincinnati
39 7140 045H01	8336	PA	Philadelphia
39 7260 005G01	6716	PA	Pittsburgh
41 0300 009F01	7948	RI	Providence
44 2540 021G01	8659	TN	Nashville
45 1310 053H01	7899	TX	Dallas
45 4570 046F01	2320	TX	San Antonio
49 1840 077F01	8529	WA	Seattle
09 0020 022I12	N.A.[b]	DC	Washington
26 4280 079H01	N.A.	MO	St. Louis

---

[a] 8760 hours in one year

[b] Data from these monitors requested, but not available

for the data indicated elsewhere on the line. In addition, it was desired to separate out weekdays, Saturdays and Sundays. This need required checking the data on each line and assigning the CO readings to the correct category. With approximately 14,000 lines of data, the editing process obviously had to be computerized. A FORTRAN computer program was written to provide the necessary editing. Appendix B contains a listing of the editing program.

Once edited, the data were processed using the SPSS program to obtain frequency distributions, the mean, median, and range of the CO data in ppm for each hour of the day for weekdays, Saturdays and Sundays. The minimum, maximum, mean and median for each hour are presented in Table III-8.

Next, the CO distributions for each hour of the day were investigated. CO distributions were generated using the SPSS computer program for each hour of the day. The ppm CO concentrations were divided into 19 intervals. To reduce the number of distributions to a more manageable level, the individual hourly distributions were examined and similar distributions combined. This process resulted in six distributions for each day type, as shown in Table III-9. These values are presented in terms of ppm CO, because it is a familiar unit. For use in the project, the ambient concentrations should be in $\mu g/m^3$ for an emission factor of 1.0 g/min.

An emission factor for a vehicle speed of 10 miles per hour was chosen for use with street canyons. The EPA provided the 1981 CO emission factors at 10 miles per hour from the MOBILE3 computer program. This emission factor, 90.31 g/mile, was converted to 15.05 g/minute by multiplying by the vehicle speed, 10 mph, in terms of miles/minute (10 mph = 0.167 miles/minute). For weekdays, the CO ppm intervals were then converted to "$\mu g/m^3$ of pollutant" intervals by multiplying the ppm values by the conversion factor for CO ppm to CO $\mu g/m^3$ (1157) then dividing by the CO emission factor of 15.05 g/minute (1157/15.05 = 76.88). This gives the CO concentration in $\mu g/m^3$ for a 1 g/min emissions rate. As is explained in Section V, the emission factor for weekends is 28 percent less than for weekdays. For weekends then, a different set of concentration values was defined using an emission factor of 10.84 g/minute, and a conversion factor from CO ppm at 10.84 g/min to $\mu g/m^3$ at 1 g/min of 106.73 (1157/10.84). The new intervals are shown in Table III-10. The distributions shown in Table III-9, with the concentrations expressed in $\mu g/m^3$ as shown in Table III-10, were used in the person hour exposure computer program for street canyon exposure.

It should be noted that the CO monitor readings used in both the street canyon microenvironment and the NEM neighborhood were at whatever ambient temperature was occurring at the time of the reading. The emission factors by which the CO concentration distributions are divided are for 75°F ambient temperature. When the 1 g/min emission factor distributions are used for other pollutants, the distributions will again be multiplied by 75°F emission factors for the pollutant under investigation. This method will yield correct exposure estimates only if the ambient temperature dependence of the pollutant under investigation is the same as that of CO. If the pollutant under investigation has a different temperature dependence the correctness of the resulting exposure estimates will vary depending on the degree of similarity. An alternative method would been to have divided each sites readings into temperature ranges

TABLE III-8. DESCRIPTIVE STATISTICS FOR STREET CANYON CO READINGS

Hour	Weekdays Concentration, ppm			Saturdays Concentration, ppm			Sundays Concentration, ppm		
Ending	Range	Mean	Median	Range	Mean	Median	Range	Mean	Median
1 am	0-12	1.63	1.09	0-11	2.26	1.95	0-19.4	2.26	1.72
2	0-12.5	1.37	0.99	0-13	2.10	1.49	0-16.0	2.03	1.48
3	0-12.0	1.16	0.83	0-12	1.85	1.18	0-15.3	1.78	1.13
4	0-12.5	0.99	0.75	0-9	1.42	1.00	0-14.3	1.39	0.99
5	0-15.0	0.98	0.79	0-9.5	1.20	0.96	0-13.6	1.14	0.88
6	0-11.3	1.38	1.02	0-7.3	1.21	0.98	0-12.4	1.04	0.84
7	0-17.1	2.57	2.04	0-8.8	1.49	1.06	0-11.6	1.12	0.96
8	0-24.5	3.97	3.47	0-8.5	1.78	1.49	0-10.0	1.22	0.99
9	0-28.5	4.41	3.81	0-10.2	1.99	1.70	0-10.4	1.21	1.00
10	0-17.6	3.96	3.36	0-19.0	2.12	1.87	0-12.2	1.30	1.02
11	0-18.0	3.92	3.37	0-9.5	2.28	1.99	0-10.2	1.36	1.04
Noon	0-18.5	3.97	3.45	0-11.0	2.40	2.01	0-9.0	1.46	1.04
1 pm	0-22.3	4.06	3.49	0-17.0	2.45	2.01	0-10.2	1.57	1.16
2	0-19.9	3.94	3.41	0-17.0	2.53	2.02	0-9.2	1.64	1.22
3	0-16.0	3.97	3.51	0-17.5	2.62	2.03	0-11.2	1.80	1.34
4	0-19.2	4.32	3.96	0-13.0	2.62	2.04	0-11.5	1.85	1.39
5	0-20.8	4.89	4.42	0-13.3	2.57	2.02	0-11.0	1.94	1.45
6	0-22.7	4.33	3.65	0-14.0	2.48	1.99	0-11.2	1.99	1.50
7	0-20.5	3.07	2.46	0-14.5	2.30	1.94	0-12.9	1.98	1.53
8	0-18.3	2.57	2.02	0-11.5	2.35	1.97	0-11.1	1.97	1.60
9	0-17.0	2.35	1.98	0-11.6	2.34	1.96	0-13.5	1.94	1.55
10	0-19.6	2.32	1.98	0-17.0	2.45	1.99	0-10.3	1.87	1.48
11	0-16.0	2.28	1.96	0-16.4	2.59	2.04	0-10.4	1.81	1.32
Midnight	0-17.0	2.15	1.73	0-11.5	2.50	2.00	0-10.7	1.65	1.18

TABLE III-9. DISTRIBUTION OF HOURLY AVERAGE CO LEVELS IN STREET CANYONS

PPM CO Interval	Percent Frequency for Time Interval Shown					
	Weekdays					
	1-6am	7am	8-9am	10am-3pm	4-6pm	7-Mid.
0.0-0.5	33.58	6.21	1.91	2.23	1.82	9.23
0.6-1.5	40.51	28.58	11.37	12.92	10.05	29.54
1.6-2.5	14.35	25.68	18.62	19.88	16.16	25.37
2.6-3.5	6.31	17.50	18.18	18.00	16.73	15.50
3.6-4.5	2.71	10.00	15.05	14.27	14.21	8.85
4.6-5.5	1.30	5.41	10.49	10.39	11.33	4.77
5.6-6.5	0.60	3.00	8.11	7.57	9.34	2.75
6.6-7.5	0.34	1.39	6.03	5.49	6.75	1.66
7.6-8.5	0.15	0.98	3.26	3.50	4.70	0.95
8.6-9.5	0.07	0.57	2.39	2.36	3.24	0.56
9.6-10.5	0.04	0.35	1.63	1.42	2.16	0.26
10.6-11.5	0.02	0.10	1.04	0.76	1.28	0.18
11.6-12.5	0.02	0.12	0.66	0.51	0.84	0.10
12.6-13.5	--	0.04	0.35	0.32	0.53	0.09
13.6-15.5	<0.01	0.04	0.47	0.29	0.50	0.12
15.6-18.5	--	0.02	0.30	0.09	0.24	0.04
18.6-21.5	--	--	0.07	0.01	0.09	0.02
21.6-24.5	--	--	0.03	<0.01	0.01	--
24.6-29.5	--	--	0.02	--	--	--

	Saturday					
	1-3am	4-6am	7-8am	9-noon	1-6pm	7-mid.
0.0-0.5	19.87	31.37	16.47	8.39	6.13	9.92
0.6-1.5	32.46	40.96	42.22	33.20	29.98	30.70
1.6-2.5	19.46	16.04	23.39	27.34	26.22	23.11
2.6-3.5	11.62	6.18	10.79	15.64	15.69	15.72
3.6-4.5	6.50	3.31	4.57	8.29	9.47	9.55
4.6-5.5	3.72	1.14	1.41	4.24	5.48	4.62
5.6-6.5	2.61	0.57	0.70	1.49	3.25	2.38
6.6-7.5	1.68	0.30	0.30	0.78	1.67	1.57
7.6-8.5	1.01	0.07	0.10	0.38	0.98	1.16
8.6-9.5	0.50	0.07	0.05	0.15	0.56	0.62
9.6-10.5	0.34	--	--	0.03	0.27	0.34
10.6-11.5	0.13	--	--	0.03	0.10	0.19
11.6-12.5	0.07	--	--	0.03	0.08	0.05
12.6-13.5	0.03	--	--	--	0.05	0.02
13.6-15.5	--	--	--	--	0.02	0.02
15.6-18.5	--	--	--	--	0.05	0.05
18.6-21.5	--	--	--	0.03	--	--

TABLE III-9 (CONT'D). DISTRIBUTION OF HOURLY AVERAGE CO LEVELS IN STREET CANYONS

PPM CO Interval	Percent Frequency for Time Interval Shown					
	Sunday					
	1-2am	3-4am	5-10am	11am-2pm	3-11pm	Midnight
0.0-0.5	18.51	27.18	28.73	18.47	14.84	20.64
0.6-1.5	31.90	38.85	48.47	46.72	39.46	40.87
1.6-2.5	20.31	16.18	15.09	19.76	21.86	18.15
2.6-3.5	11.49	8.30	4.89	9.30	11.60	11.20
3.6-4.5	7.64	3.84	1.43	2.99	5.74	4.77
4.6-5.5	3.08	1.97	0.91	1.67	2.96	2.49
5.6-6.5	3.38	1.66	0.17	0.48	1.54	0.73
6.6-7.5	1.44	0.93	0.12	0.25	0.89	0.62
7.6-8.5	1.08	0.41	0.05	0.20	0.43	0.10
8.6-9.5	0.41	0.31	0.03	0.10	0.28	0.21
9.6-10.5	0.15	--	0.03	0.05	0.26	0.10
10.6-11.5	0.21	0.16	0.02	--	0.11	0.10
11.6-12.5	0.21	--	0.05	--	0.01	--
12.6-13.5	--	0.10	--	--	0.02	--
13.6-15.5	0.05	0.10	0.02	--	--	--
15.6-18.5	0.10	--	--	--	--	--
18.6-21.5	0.05	--	--	--	--	--

TABLE III-10. CONVERSION TABLE OF MEASURED PPM CO TO $\mu g/m^3$ FOR 1 g/min EMISSION FACTOR FOR STREET CANYONS

Measured PPM CO	$\mu g/m^3$ for 1.0 g/min Emission Factor Weekdays	Weekends
0	0	0
0.5	38	53
1.5	115	161
2.5	192	267
3.5	269	375
4.5	346	481
5.5	424	587
6.5	500	695
7.5	577	801
8.5	654	909
9.5	730	1015
10.5	807	1123
11.5	884	1229
12.5	961	1336
13.5	1038	1443
15.5	1192	1657
18.5	1422	1977
21.5	1653	2298
24.5	1884	2619
29.5	2268	3153

and develop frequency distributions for each temperature range. The one gram/minute concentration distributions would then be obtained by dividing by emission factors specific to those temperature ranges. While the method is possible, the time and effort allotted for this project did not permit its use.

IV. NEM NEIGHBORHOOD/MICROENVIRONMENT POPULATION

This section summarizes the details behind the NEM CO study activity pattern population estimates. It is emphasized that the NEM CO study was a previous study conducted for the purpose of regulatory analysis. The current study used the NEM CO activity pattern populations because they appeared to be the best available at the time. The approach and assumptions explained in this section are those from the NEM CO study as understood by the author of this report.

The NEM CO computer program uses data from one city at a time. In the NEM CO computer study, four cities were investigated: Chicago, Philadelphia, St. Louis, and Los Angeles. It was desired to have the population of each city assigned (for each hour of the day) to neighborhood categories that would match the EPA CO monitor location designation. This assignment was desired because the monitor data in the EPA SAROAD data base was used to determine the CO concentration levels to which the population was exposed. The six neighborhoods used to classify the CO monitor are:

- Urban core residential
- Urban core commercial
- Urban core industrial
- Suburban residential
- Suburban commercial
- Suburban industrial

In an actual city these neighborhoods are often intertwined, and do not match areas such as census tracts for which population information is available. Thus, population information is not available for these neighborhood classifications. An example of this intertwining can be seen in the patterns of neighborhood types in a portion of the Philadelphia area, shown in Figure IV-1.

NEM Districts

In order to simplify the situation and be able to use areas for which population information was available, large portions of each of the cities, representing contiguous census tracts, were designated by the NEM developers as either urban core (called center-city in NEM reports) or suburban. These areas of contiguous census tracts were designated "districts." The district boundaries for each of the four cities in the NEM CO study are shown in Figures IV-2 through IV-5. The urban/suburban designation for each of these districts are listed in Table IV-1.

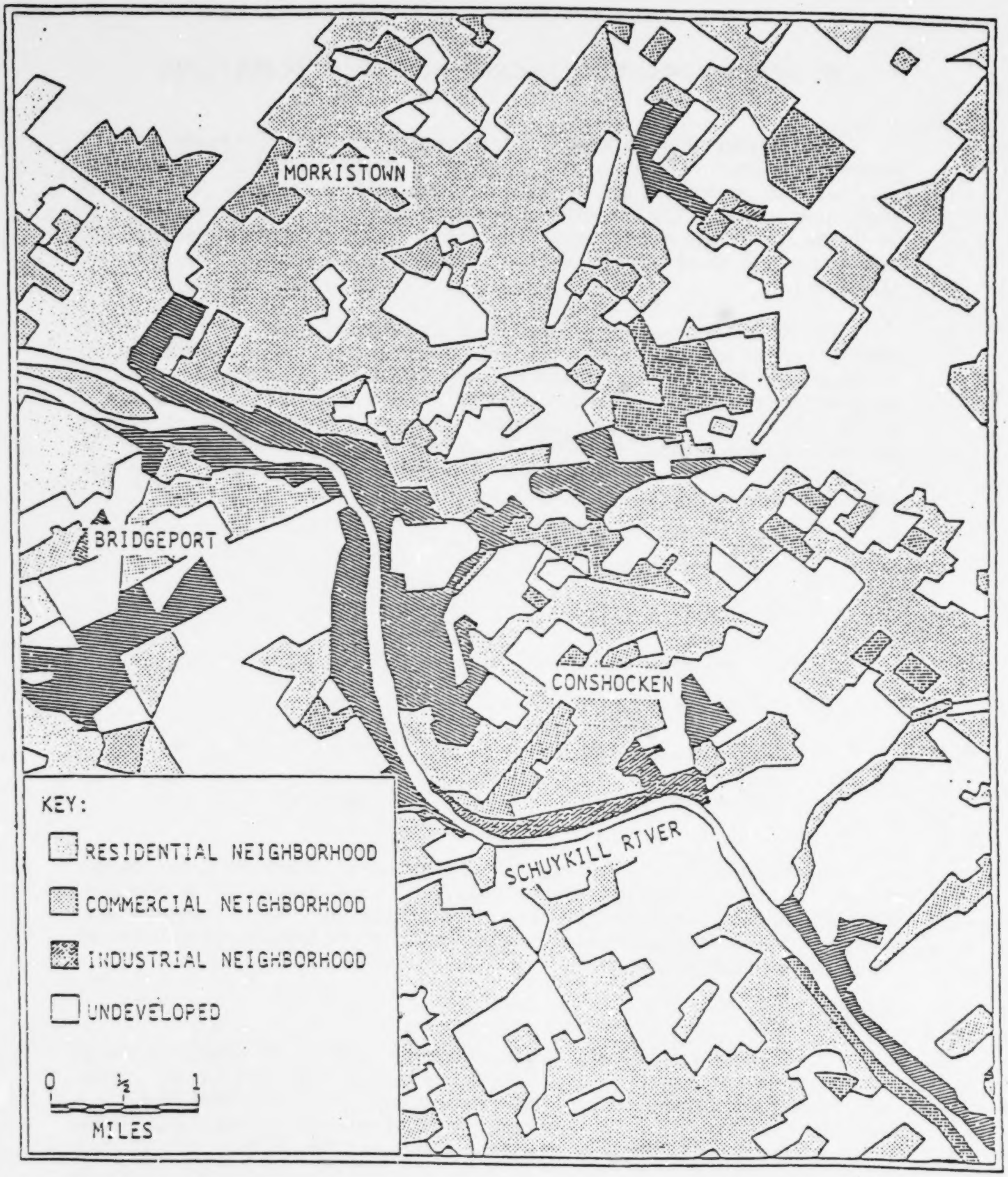
MORRISTOWN
BRIDGEPORT
CONSHOCKEN
SCHUYKILL RIVER
KEY:
RESIDENTIAL NEIGHBORHOOD
COMMERCIAL NEIGHBORHOOD
INDUSTRIAL NEIGHBORHOOD
UNDEVELOPED
0
½
1
MILES

Figure IV-1. Pattern of neighborhood types in a portion of the Philadelphia study area

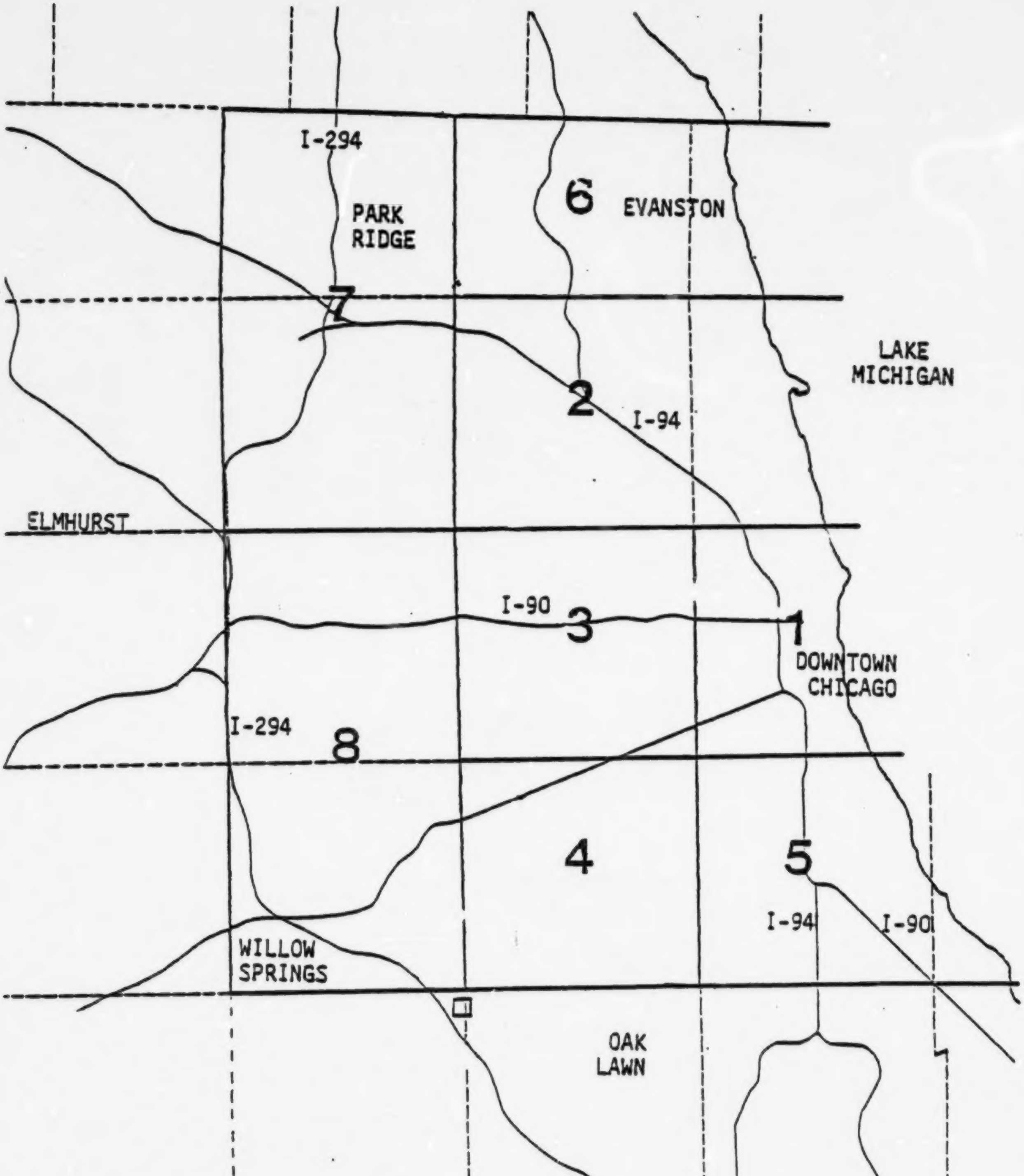
I-294
PARK RIDGE
6
EVANSTON
7
LAKE MICHIGAN
2
I-94
ELMHURST
I-90
3
1
DOWNTOWN CHICAGO
I-294
8
4
5
I-94
I-90
WILLOW SPRINGS
OAK LAWN

Figure IV-2. Chicago study area

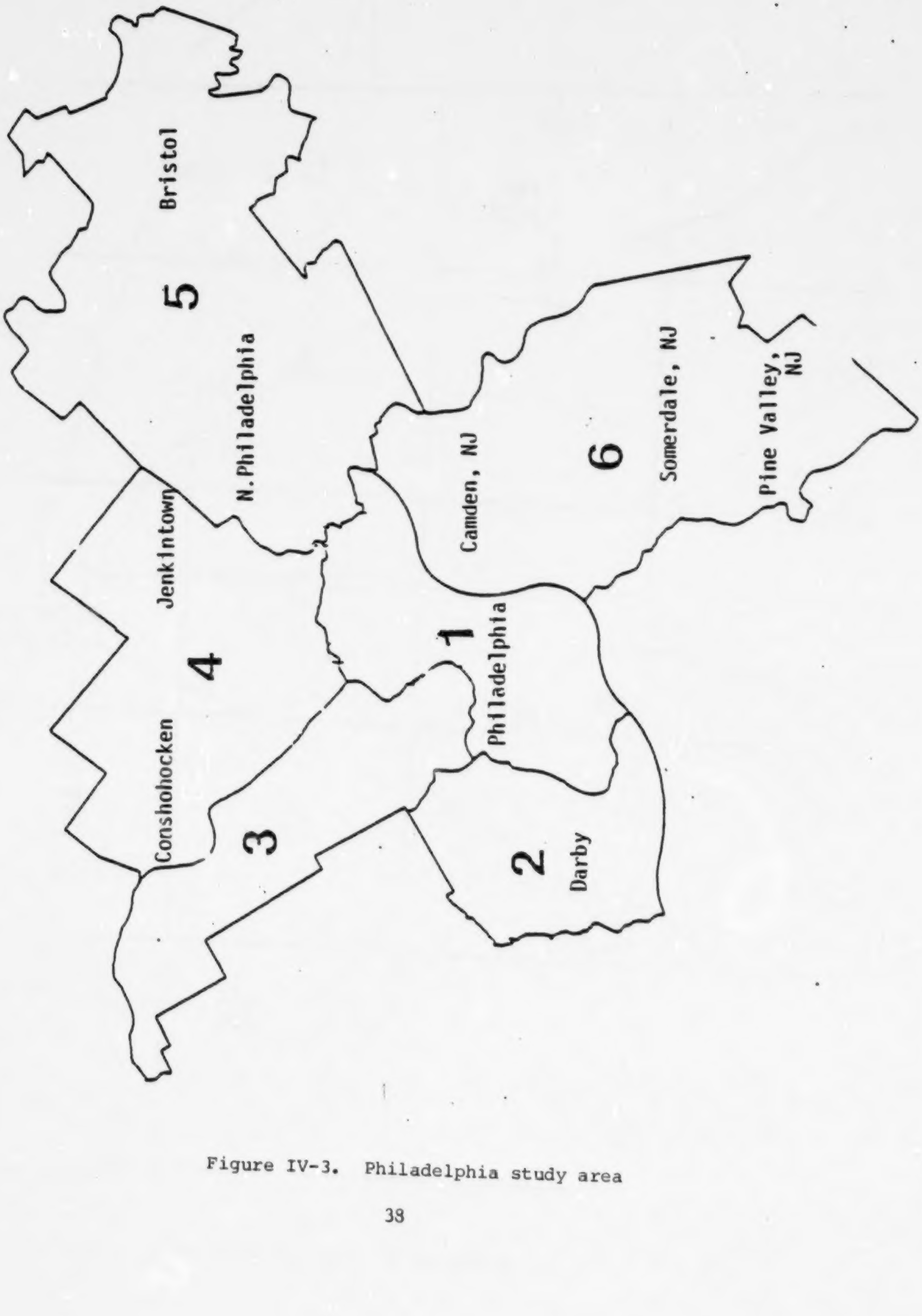
Bristol
5
N.Philadelphia
Jenkintown
4
Conshohocken
3
1
Philadelphia
2
Darby
Camden, NJ
6
Somerdale, NJ
Pine Valley, NJ

Figure IV-3. Philadelphia study area

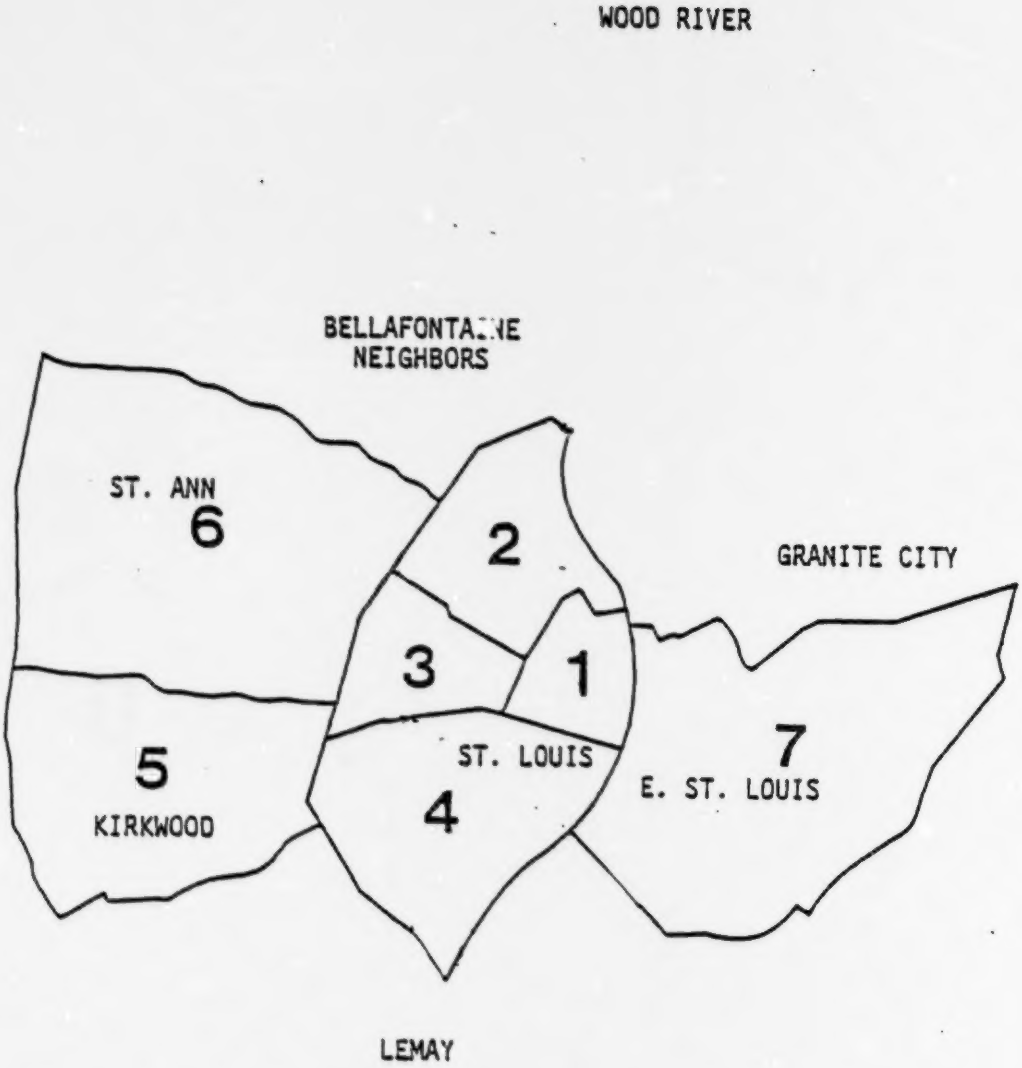
WOOD RIVER
BELLAFONTAINE
NEIGHBORS
ST. ANN
6
2
GRANITE CITY
3
1
7
5
ST. LOUIS
E. ST. LOUIS
4
KIRKWOOD
LEMAY

Figure IV-4. St. Louis study area

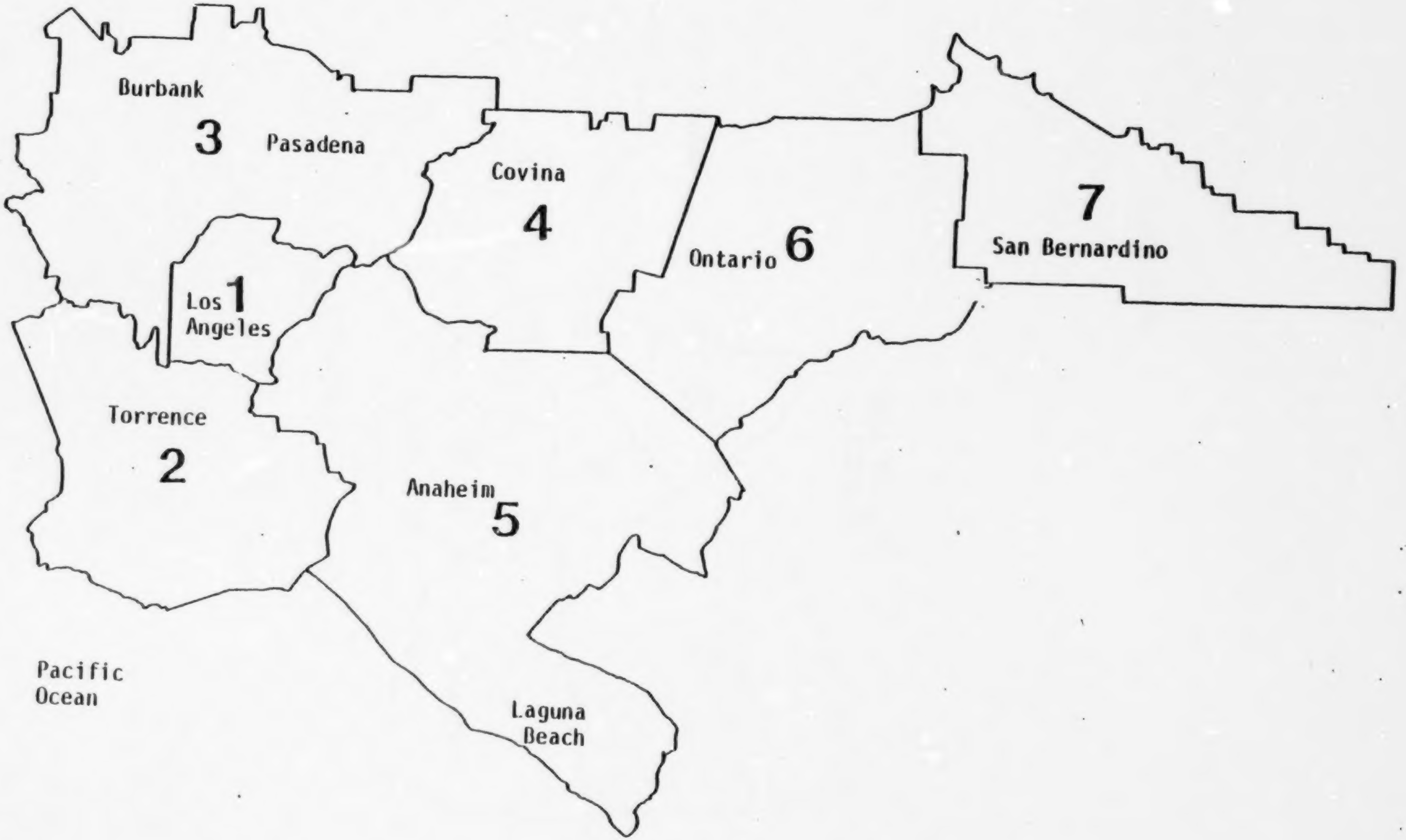
Burbank
3
Pasadena
Covina
4
Ontario
6
7
San Bernardino
Los
1
Angeles
Torrence
2
Anaheim
5
Pacific
Ocean
Laguna
Beach

Figure IV-5. Los Angeles study area

TABLE IV-1. GEOGRAPHIC CLASSIFICATION OF DISTRICTS FROM NEM CO STUDY

City	District Number	Neighborhood Designation	Page
Chicago	1	Urban Core	37
	2	Urban Core	
	3	Urban Core	
	4	Urban Core	
	5	Urban Core	
	6	Suburban	
	7	Suburban	
	8	Suburban	
Philadelphia	1	Urban Core	38
	2	Suburban	
	3	Suburban	
	4	Suburban	
	5	Suburban	
	6	Suburban	
St. Louis	1	Urban Core	39
	2	Urban Core	
	3	Urban Core	
	4	Urban Core	
	5	Suburban	
	6	Suburban	
	7	Suburban	
Los Angeles	1	Urban Core	40
	2	Suburban	
	3	Suburban	
	4	Suburban	
	5	Suburban	
	6	Suburban	
	7	Suburban	

Age-Occupation Group Populations

The population of each city was divided into 12 groups of common age and/or occupation based on Bureau of Census groups. These groups are called Age-Occupation (A-O) groups. Since the districts were based on census tracts and the A-O groups based on census groups, the population of each A-O group in each district could be determined for a city from census data. The A-O populations were summed for all urban core districts and all suburban districts separately for each city. The results of these calculations are shown in Table IV-2.

TABLE IV-2. NEM A-O GROUP POPULATION BY DISTRICT CLASSIFICATION IN FOUR CITIES

Age-occupation group	Chicago		Philadelphia		St. Louis		Los Angeles	
	Center-City*	Suburban	Center-City*	Suburban	Center-City*	Suburban	Center-City*	Suburban
1. Students 18+	83,982	25,639	18,429	75,594	16,319	23,191	75,047	266,634
2. Professionals/Managers	387,741	119,336	43,002	214,878	35,848	70,853	155,876	645,758
3. Sales workers	82,701	25,482	14,398	74,567	11,729	23,063	46,364	198,847
4. Clerical and kindred workers	269,599	66,877	64,792	199,801	50,088	48,284	151,100	490,555
5. Craftsmen, foremen, kindred	174,648	60,795	39,052	116,303	24,115	27,664	66,589	333,381
6. Operatives and laborers	206,363	55,626	98,768	161,890	63,188	40,018	134,679	478,973
7. Farm workers	-	-	862	1,891	685	843	978	12,847
8. Military, service household	137,201	30,803	57,695	103,172	46,636	26,155	71,972	321,552
9. Married housewives	170,209	92,439	93,110	290,814	65,402	81,385	166,345	810,286
10. Unemployed or retired	57,399	16,385	96,979	212,055	87,668	54,180	202,601	563,154
11. Children under 5	50,295	38,455	75,481	166,766	49,973	50,029	115,731	538,814
12. Children 5-17	120,703	92,292	209,444	508,243	147,659	163,026	267,644	1,617,642
TOTALS	1,704,843	624,115	812,009	2,125,970	599,320	608,690	1,454,924	6,278,412

*This chart is from a NEM CO report. Center-City is referred to as urban core in this report.

Age-Occupation Subgroups

The A-O groups are further divided into subgroups to permit placement of individuals within the group in different neighborhoods at different times of the day. This allows for different commute times, different work shifts, indoor and outdoor work, etc. To accomplish this division into subgroups, a number of possible different group characteristics for that A-O group were envisioned, then a percentage of the A-O groups having those characteristics was assigned. The description of the characteristics of the subgroups and their percentages of the main A-O categories are shown in Table IV-3.

Location Assumptions

In order to place people in the neighborhood type listed at the beginning of this section it was necessary to make some assumptions about the physical locations of the A-O groups. The first assumption was that all people are one of only two places. They are either "at home" or "at work." (How commuting is handled will be explained later). This assumption does not specify where "hone" and "work" are. The next assumption, and a key one of the NEM CO study, is that all persons are "at home" in a residential neighborhood. Persons can be "at work" in any neighborhood. Each of the 12 A-O groups was then assigned one or two Neighborhood Types (NT's) as work neighborhoods. These assignments are shown in Table IV-4.

As can be seen from Tables IV-1 and IV-2, the A-O subgroups live in only two neighborhoods (urban core residential or suburban residential). Thus, the population of the district is the population in the residential neighborhood. For some A-O subgroups, there can be two work neighborhoods different from the neighborhoods in which they live. This gives a possibility of either two or four different divisions of the A-O subgroups. In demographic studies, a group of individuals having a statistical factor in common are designated a cohort. For the NEM CO study, these divisions of the A-O subgroups are called cohorts. All members of a particular cohort have the following in common:

1) are members of the same A-O groups,

2) are members of the same A-O subgroups with a specified daily activity pattern,

3) live in the same neighborhood type (NT), and

4) work in the same NT.

Thus, the A-O subgroups can be divided into either two or four cohorts. The populations of the "home" neighborhoods are known, the problem is how to divide the A-O subgroups to obtain the cohort populations for those subgroups that have two work neighborhoods. To solve this problem, the NEM developers used data provided by regional transportation planning agencies to develop a condensed trip table whose geographic elements were the urban core and suburban district classifications. This table, showing number of trips and fractions of trips for each city in the NEM CO study is presented in Table IV-5.

TABLE IV-3. DESCRIPTION AND APPORTIONMENT OF ACTIVITY PATTERN SUBGROUPS

Age-occupation group	Subgroup		
	Code[a]	Description	Percent
Students 18 and over	011	<30 min commute, 8 a.m. class	23
	012	<30 min commute, 9 a.m. class	45
	013	>30 min commute, 8 a.m. class	11
	014	>30 min commute, 9 a.m. class	21
Managers and professionals	021	<30 min commute, single family house	47
	022	<30 min commute, others	21
	023	>30 min commute, single family house	22
	024	>30 min commute, others	10
Sales workers	031	Indoor work, <30 min commute	43
	032	Indoor work, >30 min commute	21
	033	Outdoor work	5
	034	Indoor and outdoor work	9
	035	Traveling	22
Clerical and kindred workers	041	Indoor work, 1st shift, <30 min commute	56
	042	Indoor work, 1st shift, >30 min commute	26
	043	Indoor work, 2nd shift, <30 min commute	9
	044	Indoor work, 2nd shift, >30 min commute	4
	045	Outdoor work	1
	046	Indoor and outdoor work	4
Craftsmen and kindred workers	051	Indoor work, 1st shift, <30 min commute	50
	052	Indoor work, 1st shift, >30 min commute	24
	053	Indoor work, 2nd shift	10
	054	Indoor work, 3rd shift	2
	055	Outdoor work	4
	056	Indoor and outdoor work	10
Operatives and laborers	061	Indoor work, 1st shift, <30 min commute	39
	062	Indoor work, 1st shift, >30 min commute	18
	063	Indoor work, 2nd shift	6
	064	Indoor work, 3rd shift	3
	065	Outdoor work	18
	066	Work in motor vehicle	16

TABLE IV-3 (CONT'D). DESCRIPTION AND APPORTIONMENT OF ACTIVITY PATTERN SUBGROUPS

	Subgroup		
Age-occupation group	Code[a]	Description	Percent
Service, military, and private household workers	081	Service, day time work, <30 min commute	36
	082	Service, day time work, >30 min commute	17
	083	Service, night time	22
	084	Service, in motor vehicle	3
	085	Military	14
	086	Private household	8
Housewives	091	No children at home	42
	092	Some children <13	49
	093	No children <13, some 13 to 18	9
Unemployed and retired	101	Unemployed, job hunting	20
	102	Unemployed, not job hunting	24
	103	Disabled	20
	104	Retired, full mobility	30
	105	Retired, limited mobility	4
	106	Retired, confined indoors	2
Children less than 5	111	0 to 12 months	21
	112	13 to 24 months	20
	113	25 to 36 months	20
	114	37 to 60 months	39
Children 5 to 17	121	Elementary school, <30 min commute	56
	122	Elementary school, >30 min commute, walk or bike	4
	123	Elementary school, >30 min commute, vehicle	7
	124	High school, <30 min commute	26
	125	High school, >30 min commute, walk or bike	2
	126	High school, >30 min commute, vehicle	5

[a] First two digits indicate age-occupation group, third digit indicates subgroup.

TABLE IV-4. ASSUMPTIONS CONCERNING WORK NT'S OF A-O GROUPS

A-O Group	Assumptions*
1. Students 18+	Work NT is same as home NT.
2. Professional and administrative	All work in a commercial neighborhood; some work in suburban areas, others in center-city.
3. Sales workers	Work neighborhood is suburban-commercial or center-city commercial.
4. Clerical workers	Work neighborhood is suburban-commercial or center-city commercial.
5. Craftsmen	Work neighborhood is suburban-industrial or center-city industrial.
6. Operatives and laborers	Work neighborhood is suburban-industrial or center-city industrial.
7. Farmers	There are no farmers in urbanized area.
8. Service, military and household	Work neighborhood is same as home.
9. Housewives	Work neighborhood is same as home.
10. Unemployed and retired	Work neighborhood is same as home.
11. Children under 5	Work neighborhood is same as home.
12. Children 5 to 17	Work neighborhood is same as home.

*This table is taken from a NEM CO study report. In this report, Center-City is referred to as urban core.

It is this information that is used to divide the A-O subgroups by work neighborhood.

TABLE IV-5. COLLAPSED HOME-TO-WORK TRIP TABLES, EXPRESSED AS NUMBER OF TRIPS AND (FRACTION OF TRIPS)

Study Area	From Home	To Work Center City	 Suburban
Chicago	Center-city	3,182,820(0.935)	221,720(0.0650)
	Suburban	524,260(0.843)	97,300(0.157)
Philadelphia	Center-City	270,524(0.514)	256,210(0.486)
	Suburban	256,210(0.256)	743,795(0.744)
St. Louis	Center-city	290,476(0.725)	110,044(0.275)
	Suburban	110,046(0.277)	287,154(0.723)
Los Angeles	Center-city	246,970(0.570)	1,851,400(0.430)
	Suburban	581,480(0.133)	3,800,720(0.867)

The information in Tables IV-1 through IV-5 can be used to find the population of each cohort. Calculation of cohort populations is best illustrated by an example. One cohort may be defined as those persons residing in suburban-residential NT in St. Louis who are managers or professionals (A-O Group 2), and who are located in urban core commercial NT during working hours who follow typical activity patterns of subgroup 22. This definition is consistent with the list of assumptions in Tables IV-3 and IV-4. Table IV-2 shows that 70,853 people live in suburban residential NT's in St. Louis and belong to A-O Group 2. From Table IV-4 we find that the fraction of A-O Group 2 belonging to subgroup 22 is 21 percent. From the collapsed trip table, Table IV-5, we find that 0.277 of the people from suburban residential NT's go to a center-city NT for work. Thus, we may calculate the cohort population as follows:

$$P_{5,2,22,2} = (70,853)(0.21)(0.27) = 4.122 \text{ persons}$$

Where $P_{5,2,22,2}$ = the cohort population whose home NT is number 5 (suburban residential) A-O category is number 2 (professional/manager), A-O subgroup 22, and work NT is number 2 (urban core commercial)

Populations of all cohorts were calculated similarly; a complete list of cohorts and estimated cohort populations is provided in Appendix C.

Activity Patterns

The implicit assumption in the development of the cohorts is that they are in the same place at the same time, i.e., they move from one neighborhood type to another at the same time. To define this movement, it is necessary to develop activity patterns on an hour-by-hour basis for a twenty-four hour day. In the NEM study, different activity patterns were created for weekdays, Saturday and Sunday.

If the activity patterns are developed in terms of hourly times at "home" or at "work" rather than by specific NT's, then the activity patterns can be developed at the A-O subgroup level. The activity pattern can then be used by each cohort in the A-O subgroups, with the only difference between cohorts being that the "home" and "work" neighborhoods will be different.

In addition to being assigned to either at home or at work for each hour of the day, as part of the activity pattern, subgroups were assigned to a microenvironment for each hour of the day. The microenvironments used in the NEM CO study were:

- indoors at work
- indoors - other
- transport vehicle
- roadside
- outdoors
- kitchen

Thus, a subgroup could be at home in a transport vehicle, or at work outdoors, etc. Some combinations were not used. For instance, no subgroup is at home, and indoors at work. No subgroup is at work in the kitchen.

The purpose of the different microenvironments, from an exposure standpoint, is that each microenvironment provides a different adjustment to the ambient air monitor concentration as explained in Section II of this report. Assignments to these microenvironments were by the subgroups shown in Table IV-4. That is, for any hour of the day, all the persons in an activity pattern subgroup were in the microenvironment. The at home or at work and microenvironment assignments by hour of the day were the same for all cities. These hour-by-hour assignments are listed in Appendix C.

Neighborhood Populations

Because of the activity patterns, the population of any neighborhood type changes from hour-to-hour. To obtain a neighborhood type population for any hour it is necessary to sum the populations of the cohorts in that neighborhood at the desired hour. This is done internally in the NEM computer program and not available in tabular form. For this project, the districts (Figures IV-2 to IV-5) and designations used by the NEM developers have been accepted at face value for purposes of determining the neighborhood or residence for each A-O subgroup, despite possible pockets of urban core land use in the districts designated suburban and vise versa.

For use in this project the neighborhood populations are required in terms of percent of the total city population. To convert the NEM CO population information into a form useful for this project, computer routines to convert the NEM activity patterns and cohort populations to the percentage of each city's population in each neighborhood/microenvironment (N/M) combination, for each hour of the day, were written and run. This information is shown in Appendix C for Chicago, Philadelphia, St. Louis, and Los Angeles. For each city, there is a table of percent population for each day type (weekdays, Saturdays, or Sundays). Thus, for each of the four cities, the percent of the study area population in each of 24 different N/M types, is estimated for each hour of the day. This information was then extrapolated to a national estimate as explained in Section VI.

V. MOBILE SOURCE MICROENVIRONMENT POPULATIONS

This study is concerned with the total, nationwide, annual person hours of exposure. As such, it is not necessary to know which particular people are exposed, or how each microenvironment is related to others. It is only necessary to know how many people are in each microenvironment for each hour of the day. To determine the mobile source microenvironment hourly populations, information on the number of locations, size range, and daily usage of each microenvironment was required. The published literature, as well as special sources, were used to obtain the best possible estimates of these parameters.

Number of Persons in Vehicles

To obtain the hourly population for each of the mobile source microenvironments, an estimate of the number of persons in each vehicle is required. There are a variety of estimates given in the literature. Early in this project, it was realized that obtaining an accurate estimate of person hour exposure would require defining the microenvironment populations on Saturday and Sunday, as well as during the work week (called "weekdays" in this report). Thus, any differences in vehicle occupancy between weekdays and weekends should be included in the calculations. The vehicle occupancies used in this study, taken from References 36 and 37, are as follows:

	Weekday	Saturday	Sunday
Cars	1.4[a]	2.3[a]	2.3[a]
Buses	26[b]	23[b]	10.6[b]

---

[a] From Reference 36
[b] From Reference 37

Population of Parking Garages

From the literature search conducted under Contract 68-03-2884, Task Specification 1, approximately 70 abstracts on parking garages were reviewed for information on usage and pollutant levels. Of these abstracts, ten had some useful information. This earlier study of parking garages had obtained information from several different sources on the number of parking garages in the country. The result was an estimate that varied from 5300 to 10,000 parking garages.(18) This spread in the estimated number of garages was too large to provide the estimate of the population in parking garages needed for this project.

Therefore, a list of parking garage construction projects since 1967 was obtained from Data Resources, Inc. This company provides construction statistics based on the F.W. Dodge data bank of construction projects. F.W. Dodge is widely recognized as the authoritative source for statistics on all types of construction projects. The parking garage construction projects in the

Reproduced from best available copy.

U.S. from 1967 to 1982 are listed in Table V-1. The total number of projects from 1967 to 1980 is 8499.(18) In Reference 18, construction data found in the magazine, "Parking," indicated that there were an average of 330 parking garages built per year between 1971 and 1980. Apparently, the construction reported was primarily public parking garages. The F.W. Dodge data are for all construction, and show approximately 592 garages constructed per year between 1971 and 1980. The difference between the two construction estimates is apparently a number of private garages included in the Dodge statistics. If the same ratio of public to private garages has always existed, then there would be almost twice as many parking garages in 1965 as the 1291 estimated garages. Assuming 2500 garages in 1965, and assuming 600 built in 1966, the number of parking garages in 1980 would be 11,600.

TABLE V-1. PARKING GARAGE CONSTRUCTION IN THE U.S., 1967-1982

Year	Number of Projects
1967	682
1968	664
1969	646
1970	587
1971	482
1972	535
1973	642
1974	546
1975	503
1976	493
1977	544
1978	837
1979	717
1980	621
1981	633
1982	596

Source: F.W. Dodge/Data Resources, Inc.

The total number of parking spaces in these 11,600 parking garages was calculated from the information in Reference 18 and from the information supplied by Data Resources, Inc. The garages were divided into two groups, one with 6200 large garages averaging 740 spaces per garage, and the other with 5400 smaller garages averaging 150 spaces per garage. The total number of spaces is then 5,398,000.

Only three references could be found that had information on cars in motion by time of day in a parking garage.(28,31,38) Since there are over 10,000 parking garages in the country, this is an extremely small sample. Nevertheless, this information will be used to represent the nationwide average, since it is all that is available. From the three references, a composite of weekday vehicles in motion as a percentage of garage parking capacity was obtained for each hour of the day. Similar information for Saturday was derived from data in Reference 38. The percent of vehicles in motion by hour for Sunday was estimated considering the values for weekdays and Saturday, together with the fact that for most garages, Sunday would be a day of greatly reduced activity. The average percentage of cars in motion by hour for each of the three types of days in shown in Figures V-1, V-2, and V-3.

Two important points abouts the fraction of active cars need to be emphasized. The curves presented are on a per hour basis. However, except when all vehicles are trying to leave at once, the actual time any one vehicle is in motion is much less than one hour, generally on the order of five minutes. Thus, the vehicles in motion at any instant would equal the hourly fraction divided by twelve. For the maximum fraction of active cars per hour (21.34 percent), this gave 1.78 percent active cars at any instant. This figure agrees well with an Aerospace Corp. study(39) which found an average of 1.5 percent active cars at all times in Los Angeles garages. However, after a concert or a sporting event when the garage is full and all cars are trying to leave at once, the time a car is in motion is more likely 15 or 20 minutes and the percentage of vehicles approaches the maximum hourly fraction. The percentage of cars in motion is important since it is used to select the proper pollutant concentration distribution in the calculation of person hours of exposure. The second point is that the people in the cars are, in general, not exposed to the garage pollution levels for a full hour. A fifteen minute exposure has been used in this study.

The total nationwide person hours of exposure for any hour of the day was obtained by multiplying the hourly fraction of cars in motion by the total number of garage parking spaces available nationwide, then multiplying by 1.4 persons per car for weekdays or 2.3 persons per car for weekends and dividing by four (for the assumed quarter-hour exposure). An example may help in visualizing the number of people involved in the parking garage microenvironment. For the weekday hour ending at 11 A.M., the active cars are 0.2134 of the total spaces, thus the number of people in the parking garage microenvironment during that hour in 1980 was:

$$0.2134\ (5.398 \times 10^6) \times 1.4 = 1{,}612{,}707 \text{ persons}$$

$$\text{Then: } 1{,}612{,}707/4 = 403{,}177 \text{ person hours of exposure}$$

The complete listing of parking garage person hours of exposure is shown in Table V-2.

Persons in Urban Roadway Tunnels

From previous studies at SwRI, it is known that the total number of urban tunnels is 59, and that the average daily traffic for all days of the week is 52,000.(18) If the weekly traffic distribution is known, then the weekday and Saturday and Sunday average tunnel ADT can be calculated. Since tunnels occur on all types of roadways, expressways, and arterials it was decided to average the weekly traffic distribution for several different road types to obtain a weekly distribution for urban tunnels. These distributions and the average are shown in Table V-3. It was not possible to weight them by

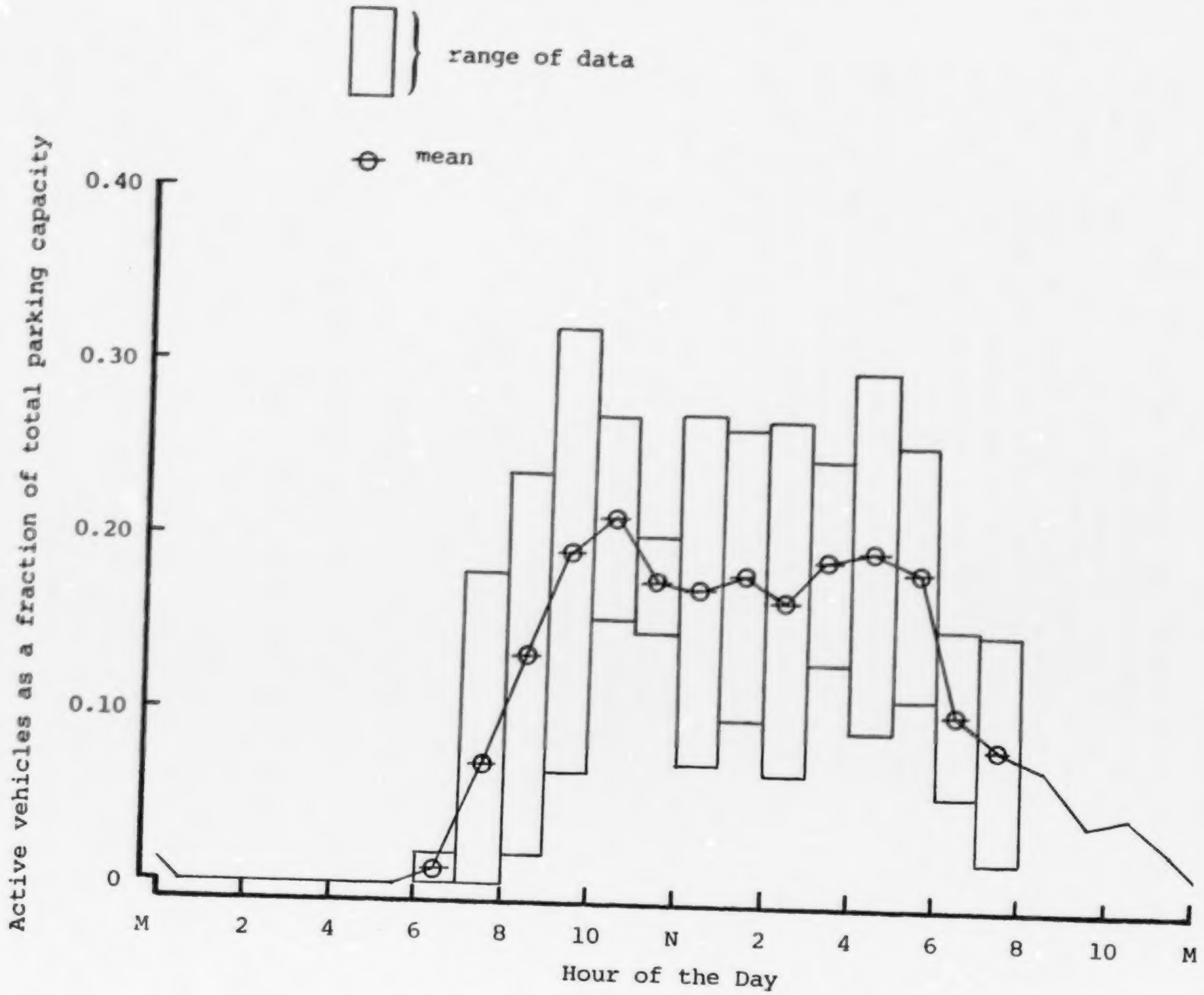

Figure V-1. Hourly average cars in motion for weekdays in Parking Garages

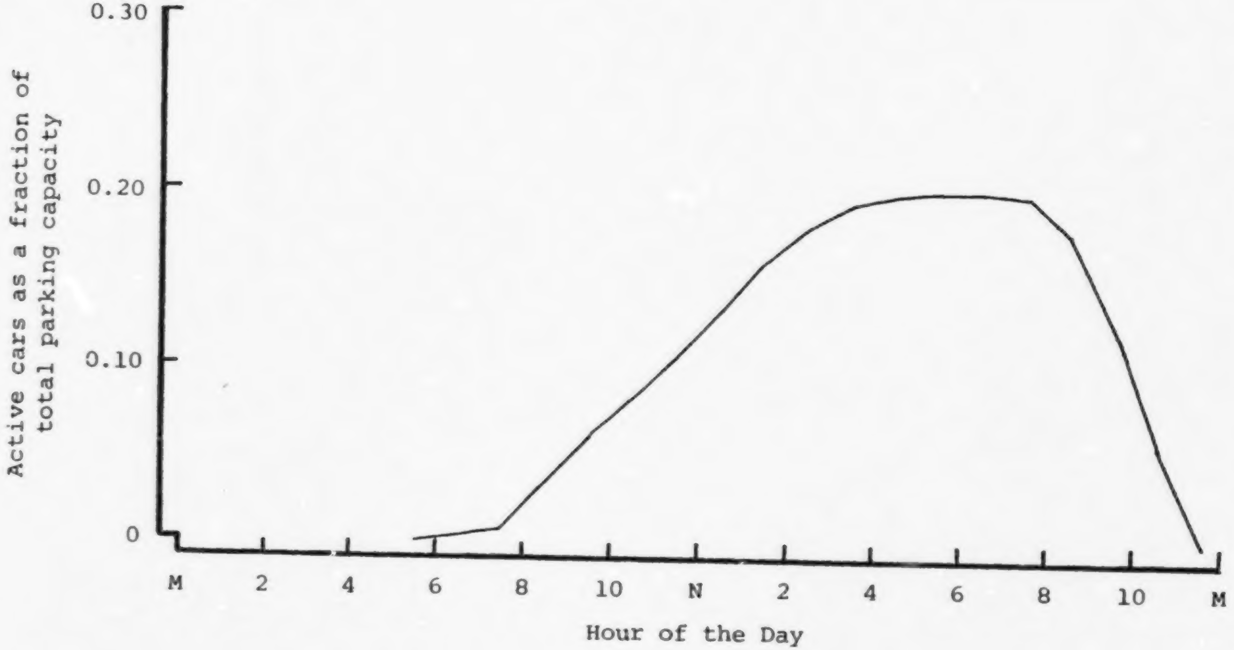

Figure V-2. Hourly average cars in motion for Saturdays in Parking Garages

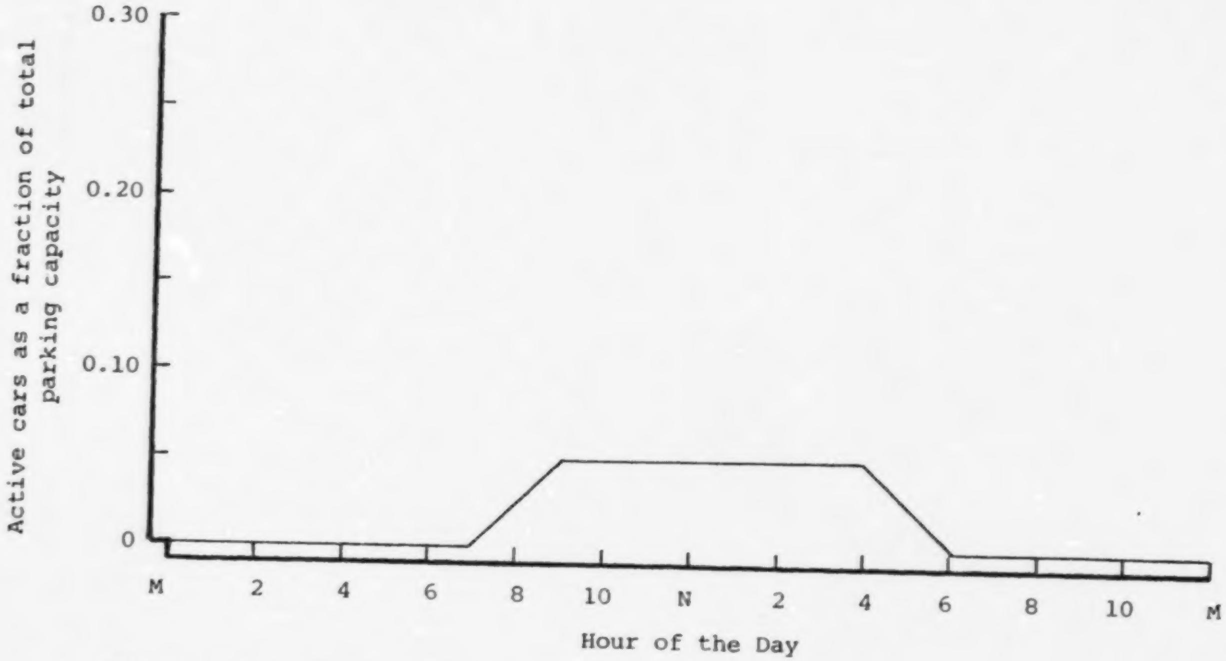

Figure V-3. Hourly average cars in motion for Sundays in Parking Garages

TABLE V-2. NATIONWIDE PERSON HOURS OF EXPOSURE IN PARKING GARAGES BY HOUR OF THE DAY

PARKING GARAGE

NATIONAL POPULATION FOR WEEKDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	0.	0.	0.	0.	0.	0.	18704.	130928.	242586.	367091.	403177.	330628.
PM	326660.	343664.	317025.	359345.	370303.	346875.	195165.	156623.	136596.	77272.	84830.	47421.

NATIONAL POPULATION FOR SATURDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	0.	0.	0.	0.	0.	0.	12415.	18623.	105531.	186231.	254516.	329008.
PM	415916.	499720.	558693.	599043.	614562.	620770.	620770.	614562.	543174.	372462.	167608.	0.

NATIONAL POPULATION FOR SUNDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	0.	0.	0.	0.	0.	0.	0.	38798.	116394.	155193.	155193.	155193.
PM	155193.	155193.	155193.	155193.	116394.	38798.	0.	0.	0.	0.	0.	0.

population, traffic, or road type since these values were not available in the references.

TABLE V-3. TRAFFIC DISTRIBUTION BY DAY OF THE WEEK FOR SEVERAL SITUATIONS

	Daily Traffic as a Percent of Weekly Traffic				
	Urban[a]	CBD[a]	Nashville Urban[b]	San Antonio Expressway[c]	Unweighted Average
Sunday	13.5	5.8	10.5	10.5	10.1
Monday	14.5	15.5	15.2	15.0	15.1
Tuesday	13.7	15.3	14.7	15.0	14.7
Wednesday	13.7	15.0	14.7	15.0	14.6
Thursday	14.0	14.8	14.7	15.0	14.6
Friday	15.0	15.5	15.9	16.0	15.6
Saturday	16.2	17.8	14.8	13.5	15.6

---

[a] Reference 40
[b] Reference 41
[c] Reference 42

From the seven day average ADT of 52,000 and the information in Table V-3, the total traffic for all 59 urban commuter tunnels can be calculated. Using 1.4 persons per car on weekdays and 2.3 persons per car on weekends, the person exposures for each day type can also be calculated. The results of these calculations are shown below.

Day Type	Total Vehicles/Day	Person Exposure/Day
Weekday	3,199,924	4,479,894
Saturday	3,350,256	7,705,589
Sunday	2,169,076	4,988,875

The hourly traffic distribution in two tunnels for weekdays and weekends was found in the literature.(34,43) One tunnel was identified as the Sumner Tunnel in Boston, the other tunnel simply as an "urban tunnel." The hourly traffic distributions for these two tunnels are shown in Figure V-4 for weekdays, and Figure V-5 for weekends. For each day type, the distributions from the two tunnels look very similar. The data were taken from different studies conducted during different years, but there is a possibility that the tunnel identified in Reference 44 as an "urban tunnel," is, in fact, the Sumner Tunnel. It is used nevertheless, since there is so little information in the literature.

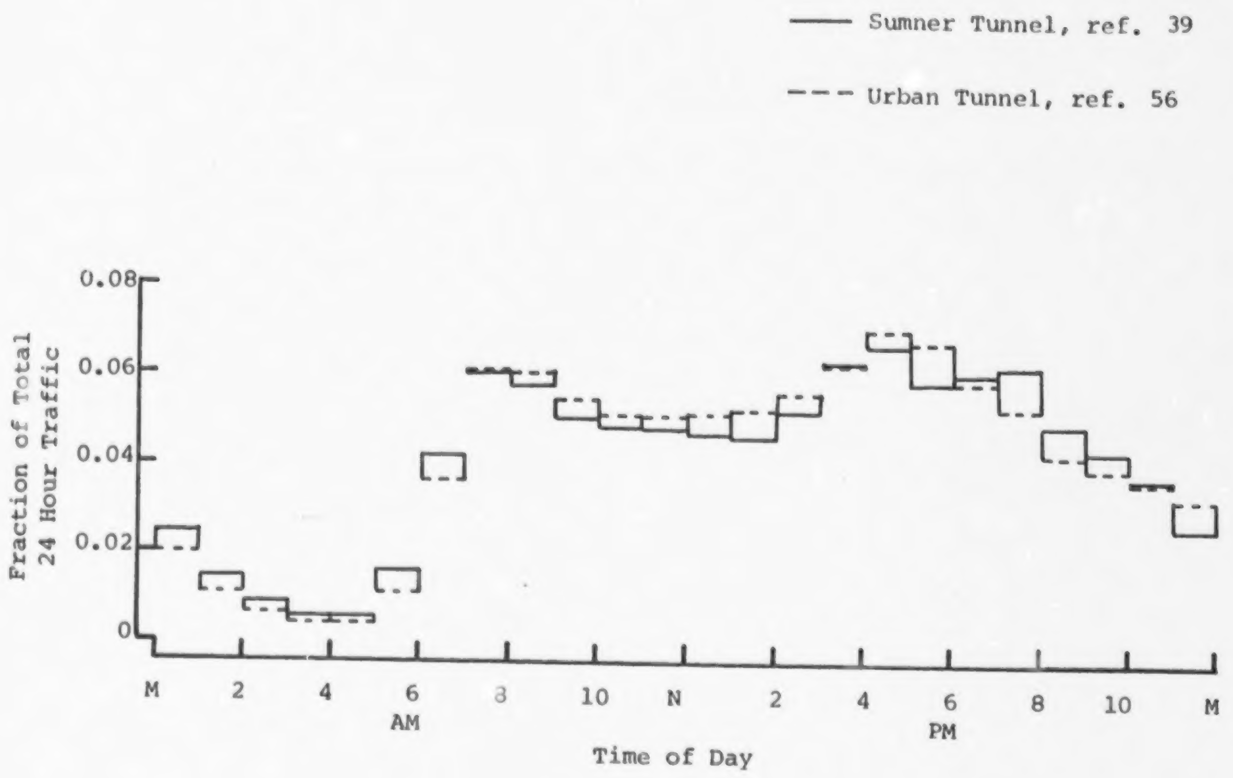

Figure V-4. Hourly tunnel traffic for weekdays

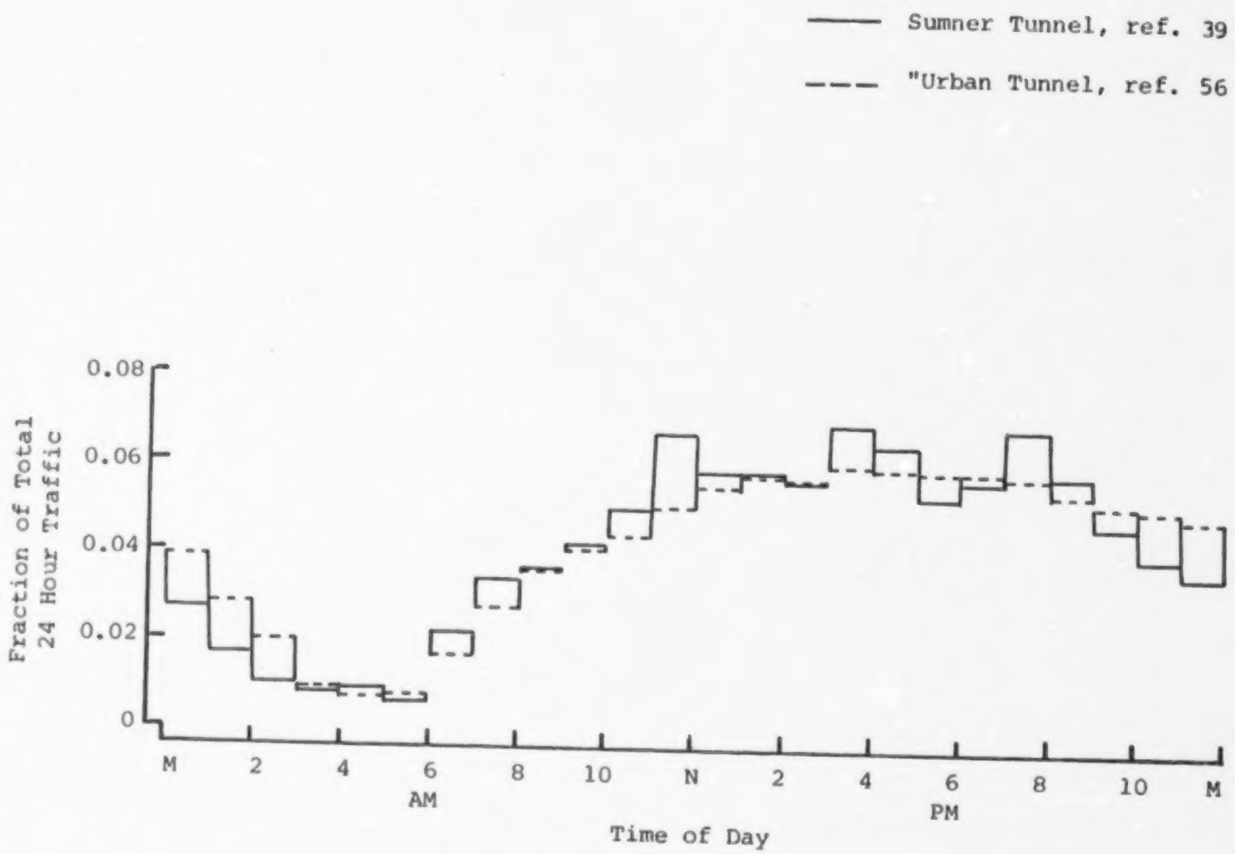

Figure V-5. Hourly tunnel traffic for weekends

No data were found on the individual period of exposure. Considering that a large number of the exposures occur during peak traffic periods when traffic is moving at its slowest rate, a five minute period of exposure was chosen for tunnels. Thus, the total person hours of exposure for any hour of the day is the person exposure per day given above, times the appropriate hourly fraction given in Table V-4 or V-5, divided by 12 (for the assumed one-twelfth hour exposure). As an example, consider the hour ending 8 A.M. on weekdays: (4,479,894 x 0.0611)/12 = 22810 person hours. The complete listing of tunnel person hours of exposure by hour of the day is contained in Table V-4.

Number of People in Street Canyons

The street canyon exposure in this project is for pedestrians and motorists within the canyon; it does not include persons in buildings adjacent to the street canyon. Therefore, the number of people and exposure times are those outside, in the canyon. Because of the sparsity of information about street canyon populations on hand, a computerized literature search was run to assist in locating additional information. Only four references were found that had information useful in determining the total number of people per day traveling to, from, or within the central business district (CBD) in vehicles.

It was clear from the information obtained that the street canyon population would have to be obtained in two parts: Vehicular and pedestrian. After examining the data found in the references, it appeared that the best way to arrive at CBD population in vehicles was to use CBD cordon counts, which were available for the peak traffic hour for a number of cities in Reference 44. Table 10-40 in Reference 44 listed the peak-hour person cordon count for the top 20 urbanized areas in the U.S. Based on these counts, there were 2,245,000 people passing the CBD cordon limits during the peak traffic hour in the 20 most populous urban areas.

Peak hour traffic generally averages about eight percent of total daily traffic.(36,41) Using this value, there would be a total of 28,062,500 person trips per day having their origin or destination within the CBD. Approximately 2.5 percent of all trips in an urban area are within the CBD, and 27.5 percent of all trips (urban and rural) either originate or end in the CBD, but not both.(40) Thus, total trips in the CBD are approximately nine percent higher (2.5/27.5 = 0.09) than measured at the cordon. To account for the intra-CBD trips, which are not measured at the cordon, the cordon counts were multiplied by 1.09 to give 30,616,188 person trips per day into, out of, or within these CBDs. The total population of these urban areas was given as 64,920,646. Using these figures, an average of 0.472 CBD trips/person per day was obtained.

Two other studies of individual cities (Rochester, NY, and San Antonio, TX) yielded 0.578 and 0.737 CBD trips per person.(45,42) From Reference 44, the urban population averages 2.43 trips per person per day for all purposes. Reference 40 indicates that 24.5 percent of all urban trips are into, out of, or within the CBD. These two figures give 0.60 trips per person per day for the CBD.

The available data on CBD person trips per day is plotted as a function of urban population in Figure V-6. Some studies have indicated that CBD trips per

TABLE V-4. NATIONWIDE PERSON HOURS OF EXPOSURE IN TUNNELS BY HOUR OF THE DAY

TUNNEL

NATIONAL POPULATION FOR WEEKDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	7466.	4779.	2987.	1904.	2016.	5227.	14821.	22810.	22250.	19712.	18853.	18704.
PM	18442.	18592.	20384.	23519.	25685.	23669.	22362.	21503.	17210.	15568.	14000.	11162.

NATIONAL POPULATION FOR SATURDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	21190.	14512.	9825.	5779.	5522.	4688.	12522.	19842.	23245.	26520.	30437.	38078.
PM	36794.	37179.	36345.	41546.	39812.	35959.	37436.	40775.	36088.	31914.	29281.	27226.

NATIONAL POPULATION FOR SUNDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	13719.	9396.	6361.	3742.	3575.	3035.	8107.	12846.	15050.	17170.	19706.	24653.
PM	23822.	24071.	23531.	26898.	25776.	23281.	24238.	26399.	23365.	20662.	18958.	17627.

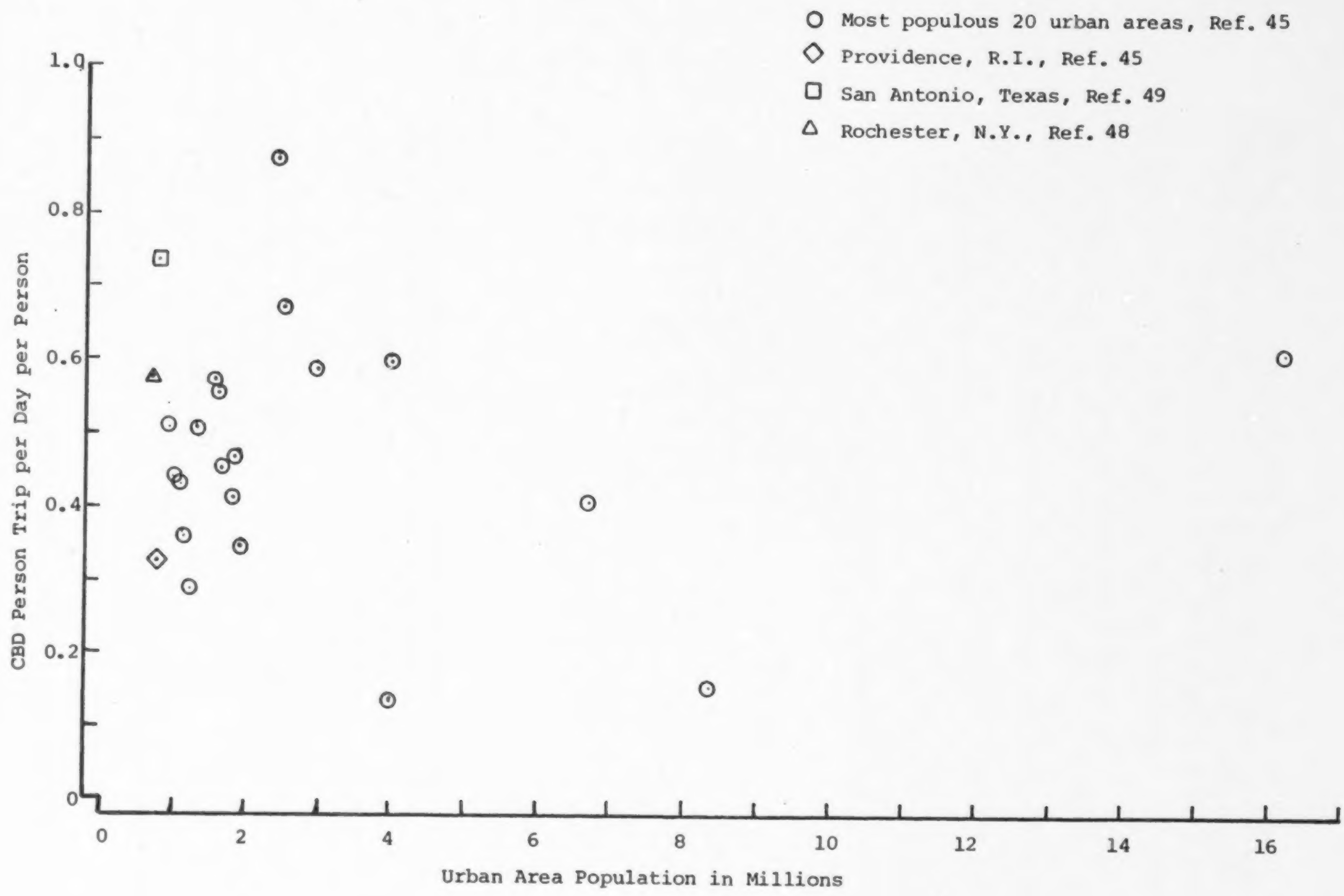

Figure V-6. Number of person trips to CBD per person in urban areas

person increase as the size of the urban area decreases. In Figure V-6, this trend appears very weak. In any case, the 0.60 CBD trips per person computed above appears high. A more reasonable average, obtained from population-weighting the data in Figure V-6, is 0.473 CBD trips per day per person.

Using the 1980 urban population of 132,023,885 and 0.473 CBD trips per person, there are approximately 62,500,000 CBD trips per day in the U.S. In earlier studies, it was assumed that street canyons constituted 60 percent of the CBD streets.(18) If CBD trips are considered equally distributed over the CBD, then there are 37,500,000 (62,500,000 x 0.600) person exposures in vehicles to the street canyon environment each day on weekdays.

For estimates of number of persons exposed on Saturday and Sunday, three weekly traffic distributions from two different references were used.(40,41) The average weekly urban traffic distribution obtained from these references is shown in Table V-5.

TABLE V-5. ESTIMATED CBD DAILY TRAFFIC AS A PERCENT OF WEEKLY TRAFFIC

	Urban[a]	CBD[a]	Urban (Nashville)[b]	Average	Used
Sunday	13.2	5.8	10.5	9.9	10
Monday	14.5	15.5	15.2	15.1	15
Tuesday	13.7	15.3	14.7	14.6	15
Wednesday	13.7	15.0	14.7	14.5	15
Thursday	14.0	14.8	14.7	14.5	15
Friday	15.0	15.8	15.9	15.5	15
Saturday	16.2	17.8	14.8	16.3	15

[a] Reference 40
[b] Reference 41

In Table V-5, the values in the column headed "Used," are the daily traffic percentages used in this study for street canyons. The weekday values were adjusted to give the same percentage for all weekdays, the Sunday value rounded off to the nearest whole percent, and the Saturday value adjusted so that the total was 100 percent.

The total number of person trips and vehicles in street canyons for each day of the week was calculated starting with the base figure of 37,500,000 persons trips in vehicles on weekdays. Of all the person trips to and from the CBD, 47.4 percent are by car and 52.6 percent by transit.(44) Of the transit trips, 74 percent are bus passengers and 26 percent are rail passengers.(46) These facts can be used to determine the total person trips by all means of transportation into the CBD as follows:

$$37{,}500{,}000 = 0.474y + 0.74\,(0.526y)$$

Where y = total number of person trips into the CBD

Solving this equation gives 43,441,000 person-trips in the CBD each weekday, with 20,590,000 (0.474 times 43,441,000) person trips by auto and 16,903,000 (0.74 times 0.526 times 43,411,000) person trips by bus. Using these values and the values of 1.4 persons per car and 26 persons per bus on weekdays as shown earlier, the weekday vehicle trips in all CBDs can be calculated as shown below:

$$\text{Weekday vehicle trips} = \frac{20{,}590{,}000}{1.4} + \frac{16{,}903{,}000}{26} = 15{,}358{,}000$$

The daily vehicle trips for Saturday and Sunday can be calculated from the weekday vehicle trips and the daily vehicle trip relationship in Table V-5. The Saturday and Sunday vehicle trips are 15,358,000 and 10,240,000, respectively. Using these vehicle trip values, the persons per vehicle shown earlier, and the weekday ratio between car person trips and bus person trips (20,590,000/16,903,000 = 1.22), the Saturday and Sunday person trips can be calculated using the following equation:

$$\text{person trips} = (1.22 + 1)\ \frac{BV}{1.22\,\frac{b}{c} + 1}$$

where: B = persons per bus

C = persons per car

V = vehicle trips

The average persons per vehicle can then be obtained by dividing the person trips by the vehicle trips. The results of these calculations are presented in Table V-6.

TABLE V-6. DAILY PERSON TRIPS AND VEHICLES IN STREET CANYONS

	Weekdays	Saturday	Sunday
Daily person trips	37,500,000	59,410,000	36,380,000
Daily vehicle trips	15,358,000	15,358,000	10,240,000
Persons per vehicle	2.44	3.87	3.55

The hourly traffic flow as a fraction of daily traffic for weekdays was obtained from Reference 36. A population-weighted average for the data from various city sizes was used. The hourly traffic distribution is shown in Figure V-7.

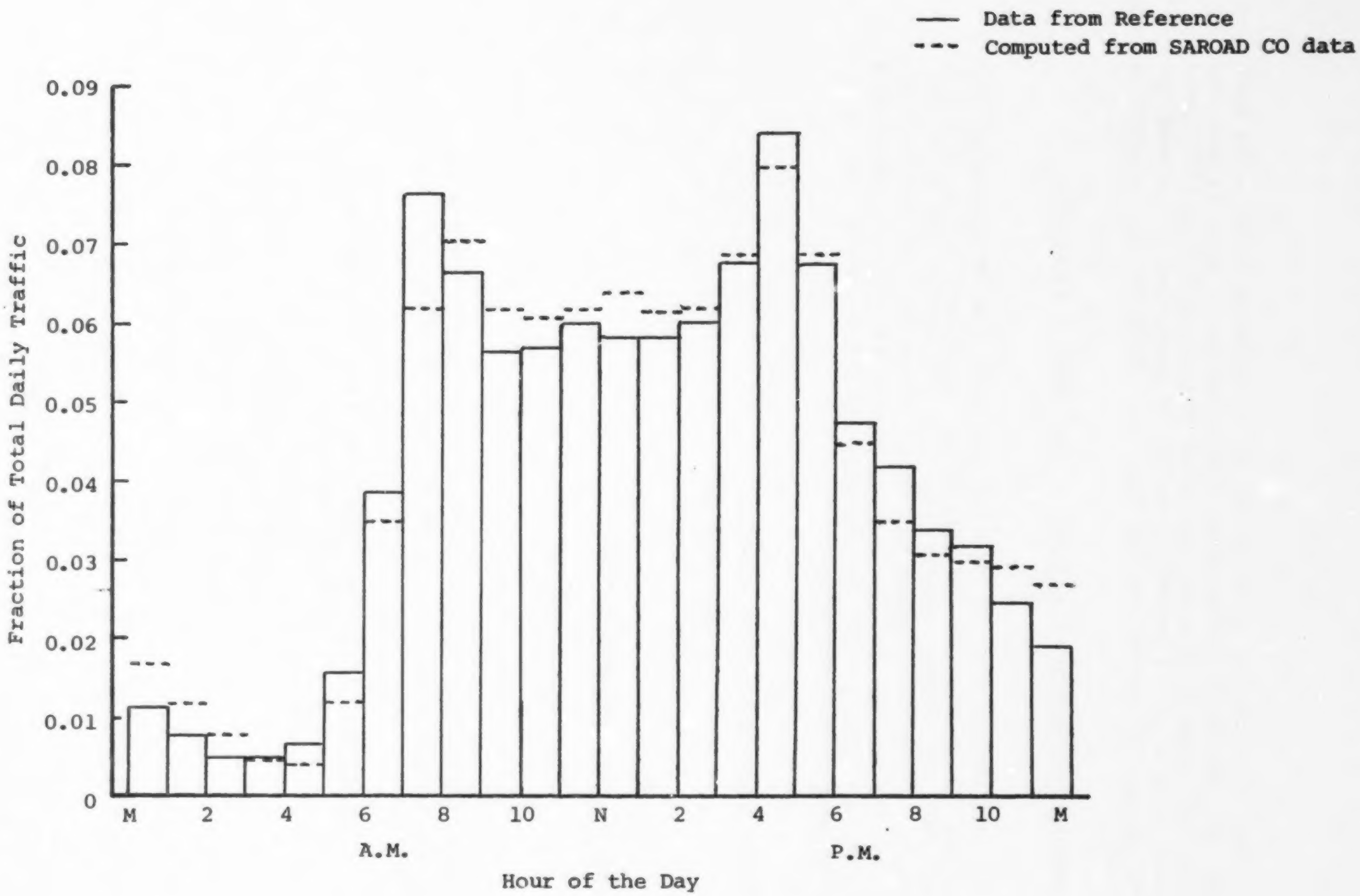

Figure V-7. Hourly traffic distribution in the CBD for an average weekday

Saturday and Sunday traffic distributions were not found in the literature for the CBD. However, if the assumption that the CO is almost entirely from mobile sources is correct, then the hourly traffic distribution should be able to be deduced from the measured hourly CO distribution for street canyons given in Section III. To check the assumption that CO level is related to traffic, the weekday traffic distribution presented in Figure V-7 was paired with the SAROAD concentration data in Section III by hour of the day. A linear regression was performed using the mean hourly CO level and the hourly percent ADT. The regression analysis produced a coefficient of determination, r^2, of 0.9598. The equation and its coefficients are:

$$p = a + bx$$

Where: $p =$ hourly percent ADT

$x =$ hourly mean ppm CO

$a = -1.4972$

$b = 1.9276$

To see the physical meaning of this equation, the linear form can be rearranged as follows:

$$P = b(x - c)$$

In this form, "c" can be thought of as the background concentration (assumed constant for the entire day), and "b" as the reciprocal of the contribution of one percent ADT to the ambient CO PPM.

Since: $P = b(x - c) = bx - bc$

Then: $a = -bc$

and: $c = -\frac{a}{b}$

Thus, from the regression analysis (for weekdays):
background concentration = -(-1.4972/1.9276) = 0.777 ppm, and
"b"(reciprocal of ADT "Emission factor") = 1.9276 (percent ADT/PPM).

The percent ADT for each hour of the day for weekdays was calculated using the above equation. These values are also shown in Figure V-7 for comparison with traffic count data. As would be expected from the high coefficient of determination, the two values of ADT agree closely, demonstrating that the hourly CO pattern can be used to develop an hourly traffic pattern.

Implicit in the equation is some actual value for the weekday ADT. To apply this equation to Saturday and Sunday, the "b" coefficient must be adjusted for the traffic count difference between weekdays and Saturdays and Sundays. The "b" coefficient was changed by the ratio of weekday vehicles to Saturday and Sunday vehicles. The ratio was 1.0 for Saturday and 1.5 for Sunday. However, when the weekday equation, adjusted for traffic differences, was applied to the Saturday and Sunday CO distribution, the calculated hourly percent ADT values did not total 100 percent.

After some thought, it was realized that the weekend on-the-road fleet had a smaller percentage of commercial vehicles (mostly trucks) than the weekday fleet. Since truck CO emissions can be several times car emissions, this change would reduce the fleet CO emission factor on weekends. With lower mobile source CO emissions and reduced industrial activity, the weekend background would also probably be lower.

If the emission factor and background are assumed to be equal on Saturday and Sunday, but the Sunday traffic is two-thirds of the Saturday traffic, then two equations can be written for the percent ADT as a function of PPM with only two unknowns; the background and the "b' coefficient. When these two equations are solved, the resulting background level is 0.589 PPM. The "b" coefficient for Saturday, which had the same total traffic as weekdays, is 2.650. This is equivalent to a 28 percent reduction from the weekday fleet emissions factor. The "b' coefficient for Sunday is 1.5 times the Saturday coefficient (or 3.975) to account for the reduced Sunday traffic. The "percent of ADT" distributions which result from applying these equations to the hourly PPM readings (in Table III-8 of Section III) are shown in Figures V-8 and V-9 for Saturday and Sunday, respectively.

Three references for pedestrian street canyon population were all that could be found in the literature.(47,48,49) The total number of pedestrian trips was calculated from Reference 49, which indicated that there were 5.8 weekday pedestrian trips for each weekday vehicle trip into the Chicago CBD. Since no other information could be found, this number was used for all CBD's in the country. At 5.8 pedestrian trips per trip in a vehicle in a CBD and 37,500,000 person trips in vehicles in all CBD's (Table V-6), there are 89,076,000 pedestrian trips in U.S. CBD's each weekday.

From a study of Seattle pedestrians,(48) the daily pedestrians as a percent of total weekly pedestrians were calculated. This distribution by day of the week is shown in Figure V-10. The average weekday pedestrian trips are 16.54 percent of the total weekly trips. The total weekly trips are then 538,552,000. Saturday trips are 13.0 percent of the weekly trips, giving 70,012,000 pedestrian trips on Saturday. Sunday pedestrian trips are 4.3 percent of the total weekly trips, or 23,158,000 Sunday pedestrian trips.

From the three references, hourly distributions of pedestrians in street canyons for weekdays and Saturdays were developed. These distributions are shown in Figures V-11 and V-12 as percent of total daily pedestrians. There were no distribution data available for Sundays. Therefore, the Saturday distribution in percentage terms was used for Sunday also. There were no data in the literature as to how long people spend for each pedestrian trip. Therefore, the exposure period was assumed to be 15 minutes.

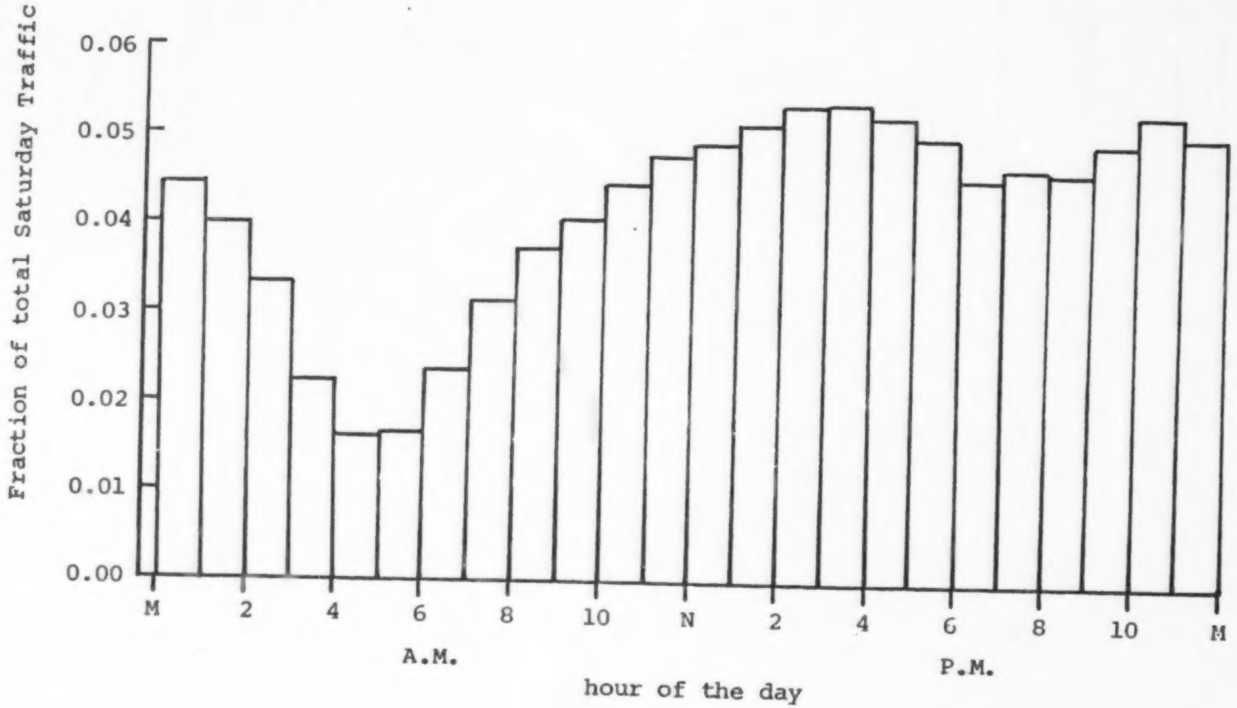

Figure V-8. Hourly traffic distribution in the CBD for Saturday

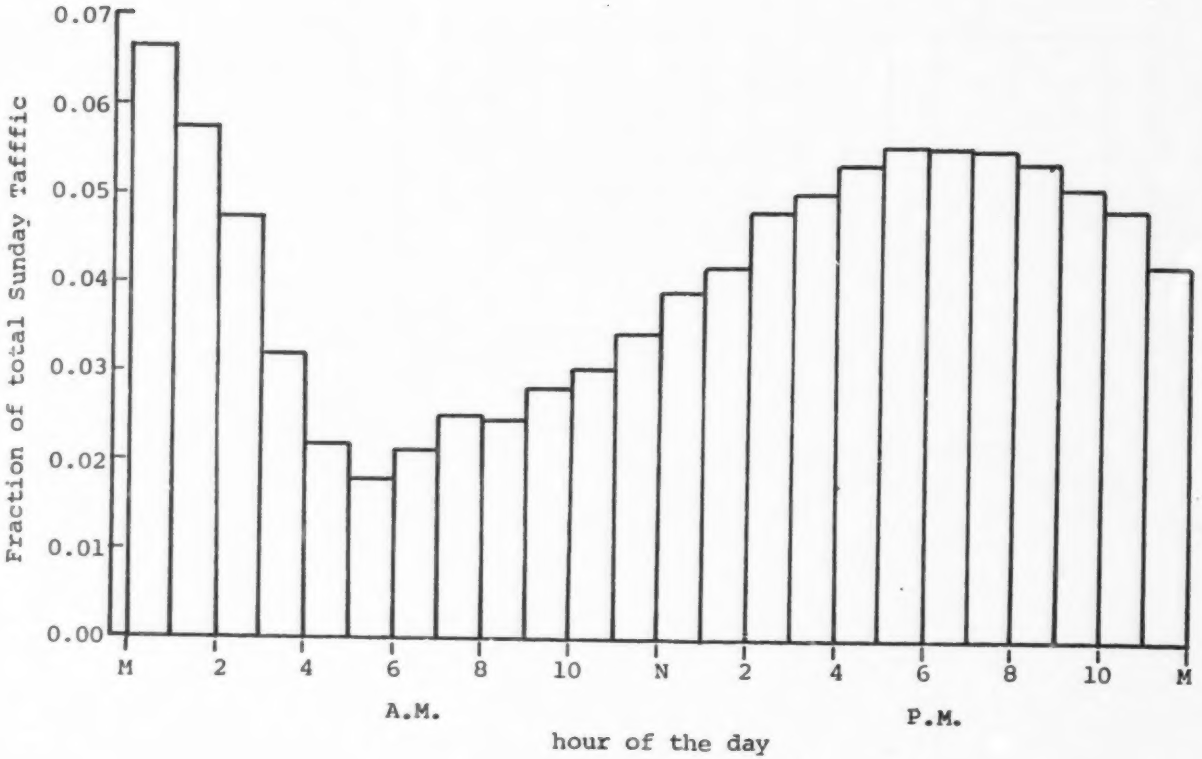

Figure V-9. Hourly traffic distribution in the CBD for Sunday

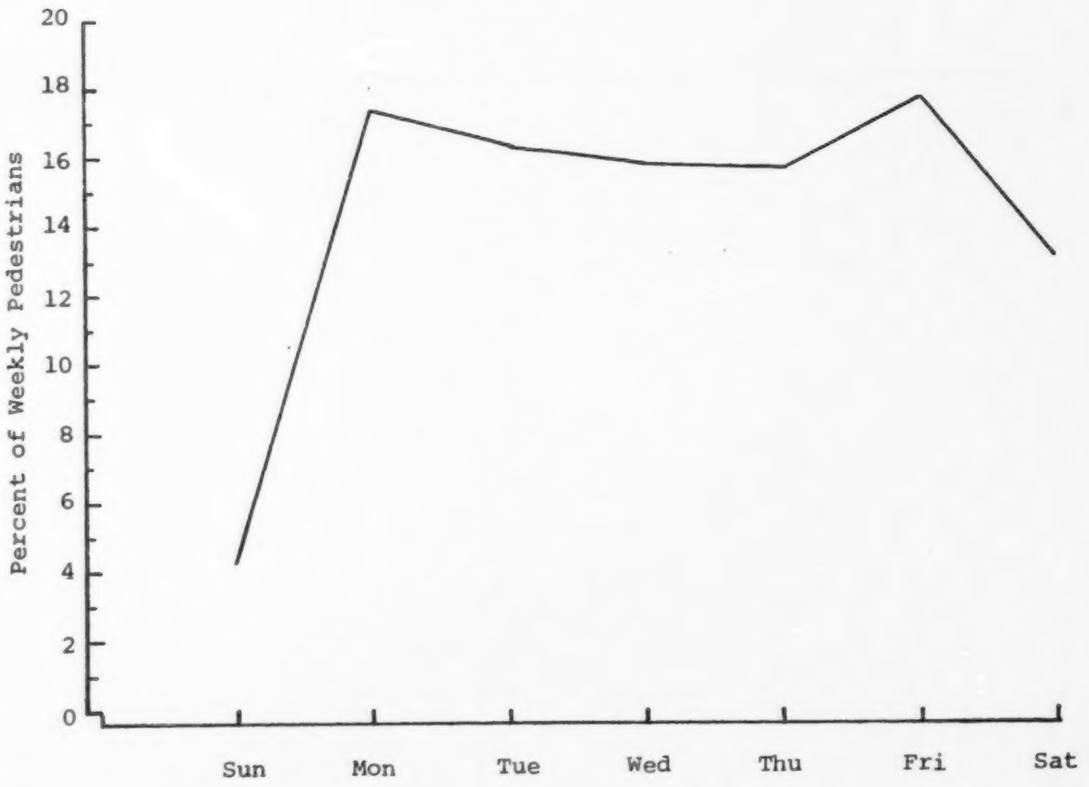

Figure V-10. Pedestrians for individual days of the week as a percent of total weekly pedestrians

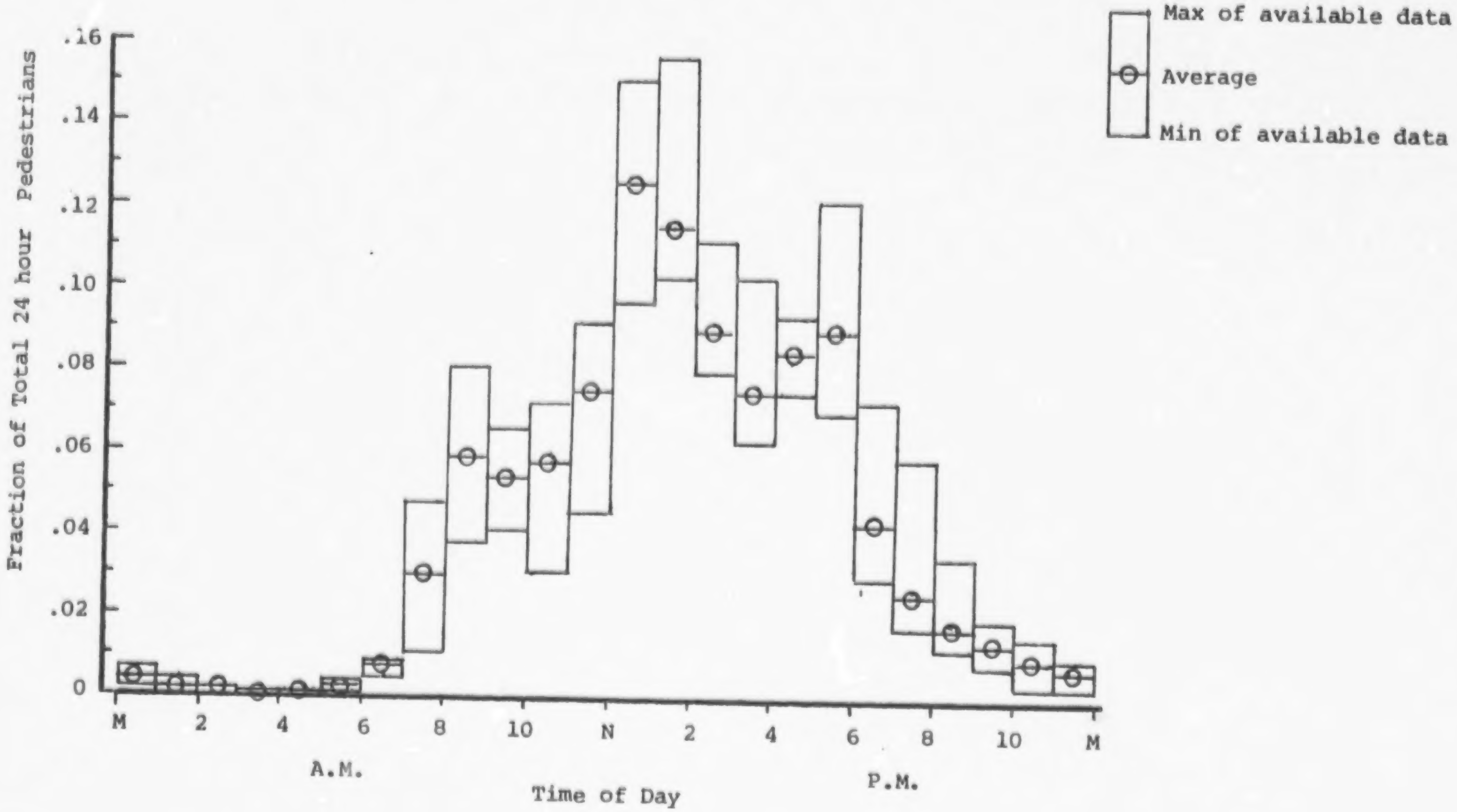

Figure V-11. Hourly pedestrian distribution in the CBD for weekdays

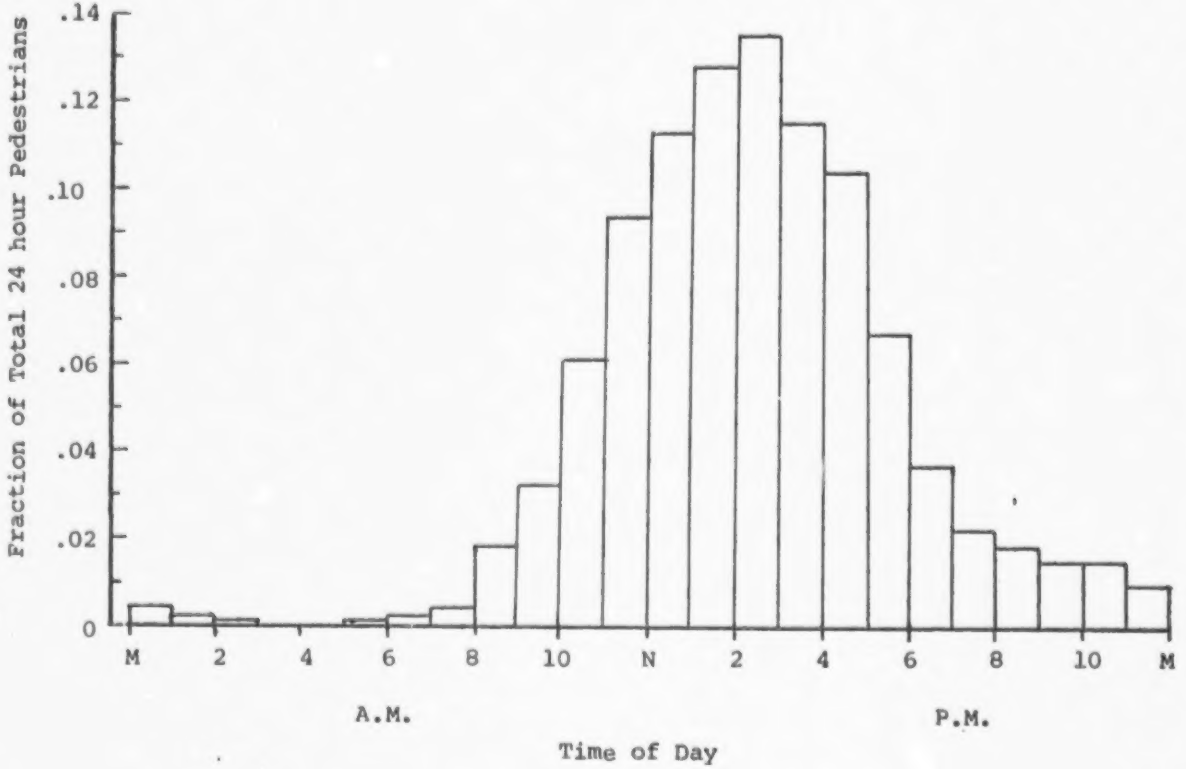

Figure V-12. Hourly pedestrian distribution in the CBD for Saturdays

To calculate the person hours of exposure in street canyons for any hour of the day, the total street canyon vehicle trips are multiplied by hourly fraction of vehicle trips, then divided by 4. The total pedestrian trips are multiplied by the hourly fraction of pedestrian trips, then divided by four. The vehicle person hours and pedestrian person hours are then added together to obtain total street canyon person hours of exposure for that hour of the day. For example, between 5 and 6 P.M. on a weekday:

(37,500,000 x 0.0675)/4 = 632,813

(89,076,000 x 00900)/4 = 2,004,210

Total street canyon person hours = 2,637,023

The complete listing of street canyon person hours is shown in Table V-7.

TABLE V-7. NATIONWIDE PERSON HOURS OF EXPOSURE IN STREET CANYONS BY HOUR OF THE DAY

STREET CANYON

NATIONAL POPULATION FOR WEEKDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	198764.	118601.	69144.	69144.	85082.	214932.	541902.	1385258.	1923246.	1732214.	1826915.	2230800.
PM	3349644.	3104685.	2567648.	2302050.	2680365.	2637023.	1422336.	969932.	717717.	608954.	453315.	356277.

NATIONAL POPULATION FOR SATURDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	739965.	632872.	517077.	329726.	239125.	266070.	393746.	548368.	873348.	1169844.	1733340.	2346215.
PM	2708582.	3002317.	3160219.	2817160.	2595082.	1913576.	1321649.	1075442.	1011476.	996258.	1049728.	912564.

NATIONAL POPULATION FOR SUNDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12
AM	629630.	533550.	436231.	290131.	199181.	169748.	205220.	253097.	331752.	442570.	631136.	854517.
PM	1008919.	1122137.	1218473.	1123189.	1088442.	892090.	717496.	627015.	596417.	549778.	527041.	437072.

VI. NATIONAL NEIGHBORHOOD POPULATION

To calculate mobile source exposure estimates based on the number of persons in different physical locations and the pollutant concentrations in those locations, it is helpful to think of the nation not as a collection of urban areas spread here and there, with suburban and rural areas in between, but rather as one large urban area, surrounded by a suburban area and a rural area, as depicted in Figure VI-1. For this project, the urban and suburban population are combined as the 1980 "urban area" populations from all 366 urban areas defined by the Census Bureau. The rural population is all the remaining population.

Figure VI-1 shows three neighborhoods in the urban and suburban areas. These neighborhoods were used in the NEM CO study. The percent of a city's population in each of these neighborhoods was determined as explained in Section IV of this report for each of the four cities used in the NEM CO study. In the NEM CO study, the same set of activity patterns and neighborhood-to-neighborhood movements was used for each city for a given classification of person (A-O subgroups). Only the number of people in each A-O subgroup changed for each city (see Section IV).

The NEM CO study produced neighborhood populations on an hour-by-hour basis for four cities. Conceivably it would be possible to use the NEM CO study methodology for each of the 366 urbanized areas in the country. Then sum each neighborhoods population to obtain nationwide population estimates for each neighborhood. In practice, this technique would have required a great more time and effort than were allotted for this project. However, for national exposure estimates, the neighborhood population for the four cities can be scaled up to national population estimates by determining the population of the other U.S. cities that are similar (ultimately in terms of hour-by-hour locations; indirectly in terms of A-O distribution, residence and work locations, etc.) to each of the four cities used in the NEM study. The procedure was to multiply the population percentages from each city by the number of people in all U.S. cities that are similar (in terms of the criteria explained below) to that city, then sum these four population tables to produce a table of nationwide population in each N/M combination during each hour of the day, for each day type.

To obtain National CO exposure the NEM CO study used a similar scaling technique on the person hours of exposure to CO levels. The lists of cities that were chosen as similar to each of the four cities investigated in the NEM CO study were obtained from Mr. William Biller, EPA consultant. From the information provided by Mr. Biller, the list of cities shown in Table VI-1 was compiled. The NEM CO study used four cities: Chicago, St. Louis, Philadelphia, and Los Angeles. The cohort populations for each of these cities produced a different percentage of people in urban core neighborhoods. These percentages are shown below:

Preceding page blank

1980 Population

Urban Area (Urban Core + Suburban) Population = 139,170,613

Rural Population = 87,334,142

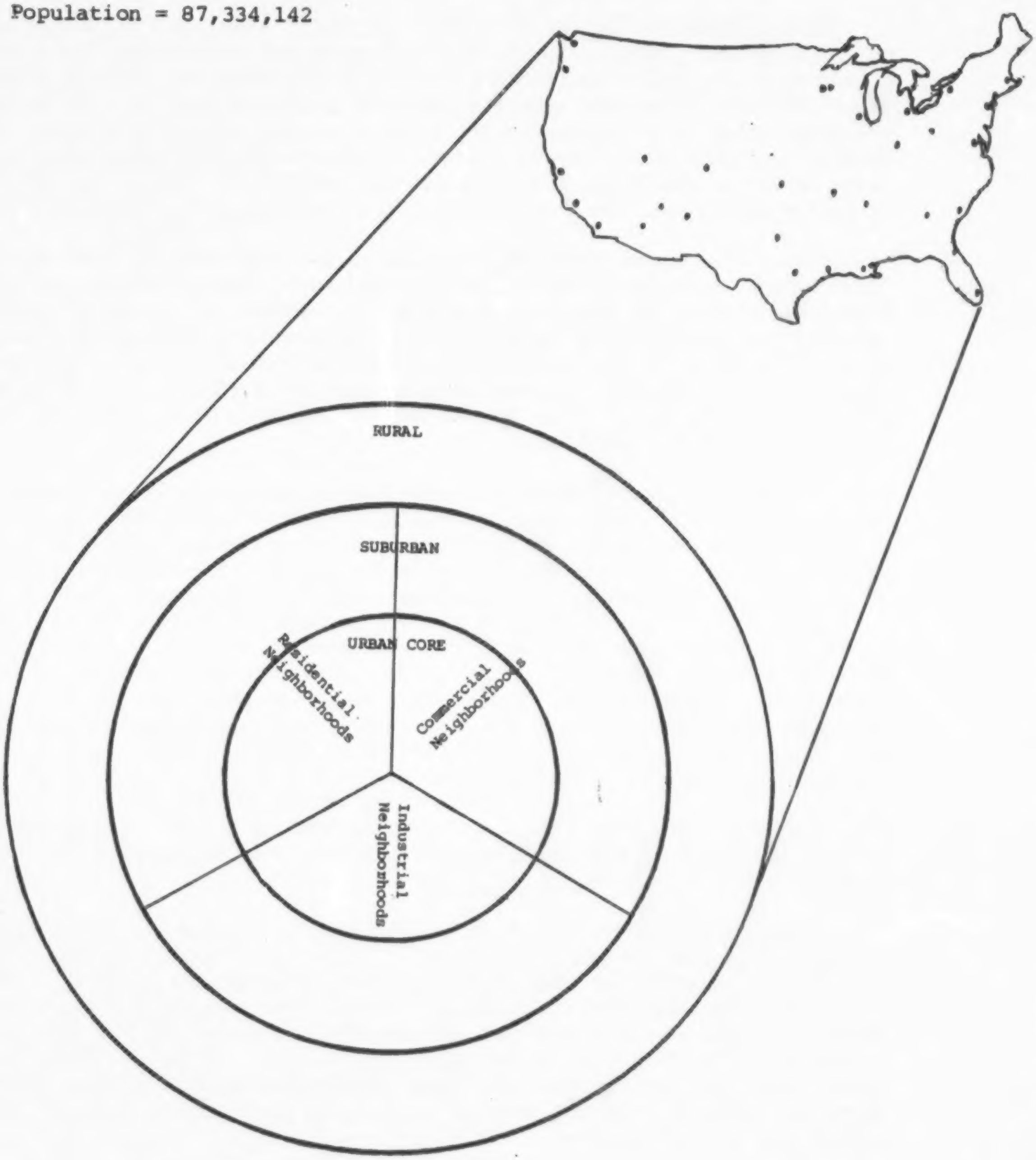
RURAL
SUBURBAN
URBAN CORE
Residential Neighborhoods
Commercial Neighborhoods
Industrial Neighborhoods

Figure VI-1. Pictorial representation of U.S. as one urban area

City	NEM CO Study Estimate of Percent of People in Urban Core
Chicago	75
St. Louis	50
Philadelphia	30
Los Angeles	20

It should be pointed out that the geographical area covered by the NEM study for any city was not the same as any of the Census Bureau-defined geographical areas for that city. More specifically, the areas used for the four cities in the NEM CO study were not the same as the Census Bureau's geographical definition of "urbanized area" for those four cities. Nevertheless, the Census Bureau populations of urbanized areas were used in the NEM CO study to extrapolate the four cities to nationwide results. For this study also, the Census Bureau populations of urbanized areas were used to extrapolate the neighborhood populations in the four cities to national neighborhood populations. As explained in the Introduction section of this report, the Census Bureau uses the phrase "center city" to mean all of the area within the city limits of an urbanized area's central city. Thus, the census information on percent of people in the center city cannot be used by itself to determine the percent of people in the "urban core" neighborhood type though it is possible that in some cases urban core may equal center city.

When the NEM CO Study list of cities in Table VI-1 was examined, it became apparent that the NEM assignment of cities would not be suitable for this project and that different criteria for determining similar cities were necessary. As one example, Jacksonville, Florida is listed in Table VI-1 as a Chicago-like city (i.e., one with 75 percent of the population in the urban core). It is true that the census figures show 89 percent of the people in the Jacksonville urbanized area living in the center city limits. What is not evident is that the Jacksonville city limits extend far beyond most of the urban core area. Driving through the city reveals that most of the land within the Jacksonville city limits could be classified as suburban, and much of it as rural.

Thus, the problem of the size of the incorporated area of a city compared to the size of its urban core area must be addressed if the census data on urbanized areas are to be used. The population density in persons per square mile, of both the portion of the urbanized areas outside the center city and the portion inside the center city, was examined for the 116 urban areas above 200,000 population. The population density outside the center cities varied from 385 to 4685 persons per square mile. Of the 116 urban areas, only 8 had population densities outside the center city below 1000. Nine urban areas had population densities above 3000 outside the center city. The population density within the center cities varied from 1343 to 22,491 persons per square mile. The urbanized area population outside the center city limits, for most urban areas will be primarily suburban. Thus, suburban population densities will be under 4685. For purposes of this study, after comparing center-city population

TABLE VI-1. NEM CO STUDY URBAN AREA CLASSIFICATION

Chicago (75% Center City Residents)	St. Louis (50% Center City Residents)	Philadelphia (30% Center City Residents)	Los Angeles (20% Center City Residents)
New York	Cleveland	Philadelphia	Los Angeles/ Long Beach
Chicago	St. Louis	Boston	Houston
San Francisco/ Oakland	Milwaukee	Washington, D.C.	Dallas
Pittsburgh	Atlanta	Minneapolis/ St. Paul	Seattle/ Everett
Cincinnati	Kansas City	Baltimore	Miami
Buffalo	Louisville	Providence/ Powtucket/ Warwick	San Diego
Indianapolis	Dayton	Columbus	Denver
Jacksonville	Ft. Lauderdale/ Hollywood	Norfolk/ Portsmouth	San Jose
Bridgeport, Conn	Birmingham	Rochester	New Orleans
Tulsa	Akron	Springfield/ Chicopee/ Holyoke	Phoenix
Grand Rapids	St. Petersburg	Toledo	Portland
Flint	Omaha	Albany/ Schenectady/ Troy	San Antonio
Southbend	Nashville	Hartford	Memphis
Davenport/ Moline/ Rock Island	Honolulu	Syracuse	Sacramento
Des Moines	Richmond	Wilmington	San Bernardino/ Riverside
Canton	Youngston/Warren	Allentown/ Easton/ Bethehem	Oklahoma City
Elgin/Aurora	Tampa	New Haven	Salt Lake City
Lansing	Orlando	Trenton	El Paso
Ft. Wayne	Wichita	Newport News/ Hampton	Tacoma
Rockford	Albuquerque	Worchester	Tucson
Madison	W. Palm Beach	Harrisburg	Spokane
Detroit	Charlotte	Charleston	Fresno
	Baton Rouge	Wilkes-Barre	Mobile
	Peoria	Scranton	Thousand Oaks/ Oxnard/ Ventura
	Columbia	Lawrence/ Haverhill	Las Vegas
	Shreveport		
	Chattanooga		
	Little Rock		
	Corpus Christi		
	Columbus		
	Colorado Springs		
	Austin		

density with known urban core characteristics for several cities, a population density of 3000 was assigned the value of 10 percent "urbanized core" (in terms of land use and population density) in character, while a population density of 10,000 or more was assigned a value of 100 percent urban core in character. The basic assumption is that urban core characteristics are proportioned to population density. A linear relationship was assumed between these two points as shown in Figure VI-2.

Figure VI-2 was used to adjust the census figures for the percentage of urban area people living inside the center city to percentage of people living in the area that is characterized as urban core. The calculations were performed as follows. The 1980 center city population density for each urban area was first obtained from census data. From Figure VI-2, the percentage of center city that is urban core was obtained using the population density. The percentage urban core (divided by 100) was multiplied by the center city population, also from census data, to obtain the number of persons in the urban core. The number of persons in the urban core was divided by the population of the whole urban area (from census data) to obtain the percentage of the urban area population in the urban core.

For example, St. Louis had a 1980 urban area population of 1,848,598, and a population within the center city limits of 453,085. The population density within the city limits was 7428 persons per square mile. Entering Figure VI-2 with 7428, it can be seen that approximately 65 percent of the center city population lives in neighborhoods that could be classed as urban core. Thus, the St. Louis urban core population is 294,505 (0.65 times 453,085). The percentage of the urban area population that lives in the urban core is approximately:

$$((294{,}505/1{,}848{,}598) \times 100) = 16 \text{ percent.}$$

When these calculations were done for the 116 urban areas over 200,000 population, a much different list of similar cities, based on residence in neighborhood type, was obtained, as shown in Table VI-2. St. Louis is classed in the NEM CO study as having 50 percent of the population within the urban core, and Philadelphia is classed as having 30 percent of the population within the urban core, yet neither city is in its respective NEM CO Study classification in Table VI-2. Thus, the city designations have been changed to type A, B, C, and D, for urban areas with 75 percent, 50 percent, 30 percent, and 20 percent of the population within the urban core, respectively. Note that there are far fewer cities in the A, B, and C categories in Table VI-2 than in Table VI-1.

From the list in Table VI-2, it may appear that the NEM CO study N/M population percentages for Philadelphia were switched from 30% urban core residents to 50% urban core residents, and that there was no NEM CO study city for the Type C area (30% urban core residents). This is not the case. The NEM CO study N/M population percentages from the four cities in the CO study were used to represent the percent urban core residents that the NEM CO study area produced. That is, the NEM CO study N/M population percentages from Chicago study was used to represent Type A urban areas, the percentages from the St. Louis study area were used to represent Type B urban area, the percentages from the Philadelphia study are were used to represent Type C urban areas, and the percentages from the NEM CO study Los Angeles study area were used to represent Type D urban areas. Because the NEM CO study

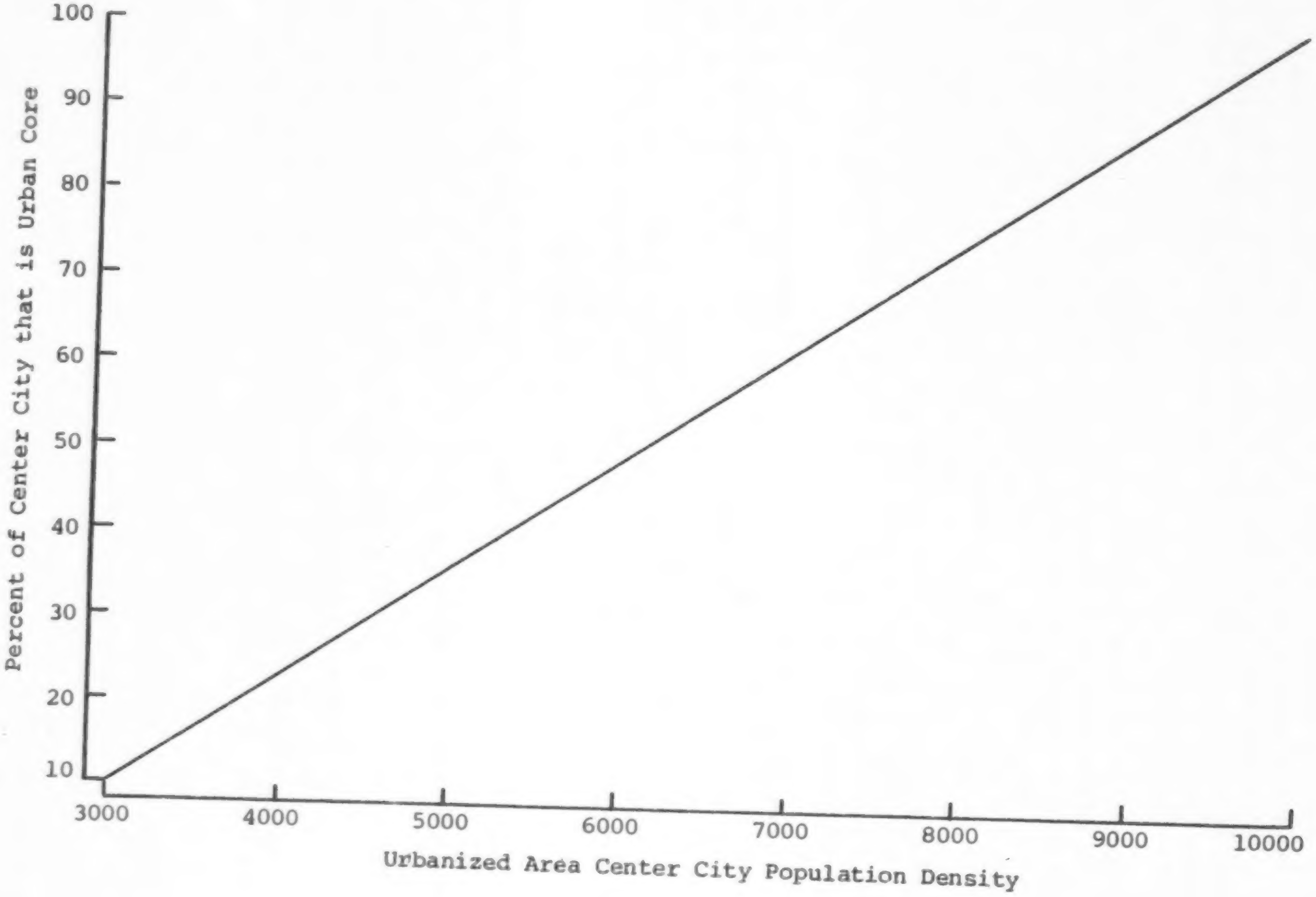

Figure VI-2. Percent of urbanized area center city that is urban core

area boundaries were not the same as the Census Bureau boundaries of the city's urbanized area, for extension to nationwide N/M populations, the value for the Philadelphia urbanized population is included in those cities that use the N/M population percentages for a Type B urban area, while the value for the St. Louis urbanized area population is included in those cities that use the N/M population percentages for a Type D urban area.

TABLE VI-2. RECLASSIFICATION OF URBAN AREAS BY PERCENT OF RESIDENTS IN URBAN CORE (BASED ON 1980 CENSUS)

Type A Urban Areas (75% Urban Core Residents	Type B Urban Areas (50% Urban Core Residents	Type C Urban Areas (30% Urban Core Residents	Type D Urban Areas (20% Urban Core Residents
New York	Philadelphia	Detroit	Remainder of urban areas
Chicago	San Francisco	Washington DC	
	Baltimore	Miami	
		Milwaukee	
		New Orleans	
		Buffalo	
		Bridgeport	
		Syracuse	
		Trenton	

For each urban area type (A, B, C, or D) the total population of all the urban areas of that type was multiplied by the percent of people in each N/M classification for that urban area type, from Section IV. The populations of the four urban area types were summed by N/M classification to produce nationwide estimates of the population in each N/M classification by hour of the day. These population distributions are included in Appendix D of this report.

The numbers of people in the Mobile Source microenvironments (street canyon, tunnel and parking garage) were determined on a national basis, as explained in Section V of this report. These mobile source populations must be subtracted from appropriate NEM N/M types for each hour of the day, since they were arrived at independently of the NEM procedure. The process of choosing the N/M types from which to subtract the various mobile source microenvironment populations highlighted one of the limitations of the NEM program. This limitation was that not every N/M type has a nonzero population for each hour of the day.

As an example, it would be most logical to subtract the hourly street canyon population from the urban core-commercial/vehicle and urban core-commercial/roadside NEM N/M types. However, some hours of the day have zero people in these N/M types. Even when there are people assigned to these N/M types, the total number is often less than the street canyon population. For most of the nighttime hours, especially on Saturday and Sunday, only two NEM N/M types have nonzero populations: urban core-residential/inside and suburban-residential/inside. These results seem to indicate that the constraints of the NEM computer program may cause certain hour populations of some N/M types to be underestimated.

The numbers of people subtracted from each N/M type, by hour of the day, for the mobile source microenvironments are shown in the tables in Appendix D of this report. The final national urban populations by N/M type are shown in Tables VI-3, VI-4, and VI-5. The explanation of the N/M codes in these tables is presented in Table VI-6. Note that the tables show "Mobile Source" as a neighborhood type, and street canyons, tunnels and parking garages as microenvironments; so that the tables present the hourly populations of all places that will be used in the calculation of exposure. As such, these tables will be the population input to the exposure computer program.

TABLE VI-3. NATIONAL POPULATION FOR WEEKDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	49165015.	49842171.	50323418.	50469392.	50453410.	50322275.	47727538.	38489899.	28359526.	24634137.	19977536.	23179919.	1/1
PM	29421948.	25524062.	21177257.	24519075.	21088961.	41284854.	47953301.	46249738.	49002430.	49068674.	49371641.	49155531.	1/1
AM	0.	0.	0.	0.	0.	0.	1293562.	3294132.	2738201.	1610992.	2757266.	645534.	1/3
PM	0.	253786.	4369018.	1774254.	3126098.	2095759.	0.	0.	0.	0.	0.	0.	1/3
AM	0.	0.	0.	0.	0.	0.	0.	589217.	0.	1155657.	0.	111651.	1/4
PM	965465.	1483189.	2409960.	393660.	192069.	1076578.	447143.	2457433.	0.	0.	0.	0.	1/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	3180132.	7828125.	6635101.	1/5
PM	192069.	3314698.	2632114.	3895133.	9103583.	2298948.	0.	0.	0.	0.	0.	0.	1/5
AM	777719.	858956.	0.	0.	0.	0.	0.	0.	14680521.	15615653.	15380564.	14925382.	2/1
PM	14022989.	14257687.	14597277.	14932097.	15340358.	979469.	379313.	553583.	531769.	622400.	469656.	590274.	2/1
AM	0.	0.	230627.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/3
PM	0.	0.	0.	0.	0.	993437.	0.	0.	0.	0.	0.	0.	2/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	116844.	212713.	2/5
PM	0.	0.	212713.	116844.	0.	0.	0.	0.	0.	0.	0.	0.	2/5
AM	1205327.	300598.	301136.	301461.	301427.	300464.	302032.	7619925.	9399576.	8082861.	7614269.	9243893.	3/1
PM	9581951.	7804537.	10085488.	8082861.	1370629.	902829.	903221.	903479.	904767.	905260.	905730.	1204218.	3/1
AM	0.	0.	0.	0.	0.	0.	1162197.	1159800.	1159968.	1160729.	0.	0.	3/3
PM	1161110.	1161065.	0.	1159587.	3595580.	0.	0.	0.	0.	0.	0.	0.	3/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2664482.	0.	3/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	182375.	1499090.	474616.	1499090.	3/5
PM	0.	1777414.	656991.	1499090.	1499090.	0.	0.	0.	0.	0.	0.	0.	3/5
AM	86130233.	87040796.	87776520.	88100716.	88100704.	88100383.	84596185.	70521658.	53444637.	46014177.	37688767.	42429594.	5/1
PM	55914265.	48813775.	41006425.	46661325.	35052502.	72797977.	83932771.	81933019.	86420767.	86423733.	86423355.	86127862.	5/1
AM	0.	0.	0.	0.	0.	0.	2410976.	7953206.	5607554.	3014452.	4487373.	1372310.	5/3
PM	0.	489617.	8048922.	3806766.	6725359.	3163320.	672102.	0.	0.	0.	0.	0.	5/3
AM	0.	0.	0.	0.	0.	0.	0.	1256062.	0.	1977865.	0.	132075.	5/4
PM	1646203.	2435232.	4124405.	835274.	423024.	1211980.	1815203.	4496270.	0.	0.	0.	0.	5/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	6972740.	15810465.	14057587.	5/5
PM	423024.	6244020.	4800733.	6673752.	19296863.	4809671.	0.	0.	0.	0.	0.	0.	5/5
AM	777021.	777290.	0.	0.	0.	0.	0.	0.	13060313.	13531034.	12858398.	13532136.	6/1
PM	13897516.	12858398.	13285185.	13722272.	14319249.	777768.	746257.	754060.	755558.	764620.	763643.	769539.	6/1
AM	0.	0.	239001.	0.	0.	0.	0.	0.	0.	182265.	606785.	0.	6/3
PM	0.	916236.	0.	0.	0.	3097123.	0.	0.	0.	0.	0.	0.	6/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	108557.	168502.	299246.	168502.	6/4
PM	0.	108557.	409054.	59039.	108557.	0.	0.	0.	0.	0.	0.	0.	6/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	108557.	195005.	6/5
PM	0.	0.	195005.	108557.	0.	0.	0.	0.	0.	0.	0.	0.	6/5
AM	918661.	230634.	230993.	231209.	231187.	230545.	231590.	5895017.	7232337.	6249720.	5891246.	7122276.	7/1
PM	7379715.	6039253.	7742569.	6249720.	1042014.	682578.	682840.	683011.	683870.	684198.	684512.	917922.	7/1
AM	0.	0.	0.	0.	0.	0.	863811.	862213.	862325.	862833.	0.	0.	7/3
PM	863087.	863057.	0.	862071.	2699788.	0.	0.	0.	0.	0.	0.	0.	7/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1985997.	0.	7/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	146473.	1119222.	354703.	1119222.	7/5
PM	0.	1339557.	499844.	1119222.	1119222.	0.	0.	0.	0.	0.	0.	0.	7/5
AM	198764.	118601.	69144.	69144.	85082.	214932.	541902.	1385258.	1923246.	1732214.	1826915.	2230800.	8/7
PM	3349644.	3104685.	2567648.	2302050.	2680365.	2637023.	1422336.	969932.	717717.	608954.	453315.	356277.	8/7
AM	7466.	4779.	2987.	1904.	2016.	5227.	14821.	22810.	22250.	19712.	18853.	18704.	8/8
PM	18442.	18592.	20384.	23519.	25685.	23669.	22362.	21503.	17210.	15568.	14000.	11162.	8/8
AM	0.	0.	0.	0.	0.	0.	18704.	130928.	242586.	367091.	403177.	330628.	8/9
PM	326660.	343664.	317025.	359345.	370303.	346875.	195165.	156623.	136596.	77272.	84830.	47421.	8/9

TABLE VI-4. NATIONAL POPULATION FOR SATURDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	50016569.	50125665.	50242866.	50431431.	50522109.	50495415.	50361663.	50202983.	50201501.	32005147.	25437801.	42484440.	1/1
PM	47083276.	36875936.	14658594.	26289070.	43914811.	47189124.	49273980.	39215619.	44492013.	49559709.	49583749.	49842159.	1/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	8945485.	6550341.	919937.	1/3
PM	1919905.	5831057.	9177135.	1339600.	2340517.	322519.	50471.	7392125.	4331413.	492730.	498855.	0.	1/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	965465.	8200614.	111651.	1/4
PM	0.	3060970.	7698840.	5083375.	771736.	1914699.	322519.	3312374.	1155657.	0.	0.	0.	1/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	8093168.	8966303.	5730261.	1/5
PM	0.	2917852.	17154931.	16179148.	1980306.	0.	123233.	0.	0.	0.	0.	0.	1/5
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/1
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/3
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	212713.	0.	2/5
PM	0.	212713.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/5
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/1
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/3
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/5
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/5
AM	88329959.	88397634.	88400914.	88403747.	88403927.	88404510.	88390336.	88380867.	87769894.	57631260.	45285644.	73757718.	5/1
PM	83334542.	64331774.	25814180.	47694445.	78635548.	84315769.	86546516.	67029268.	77675979.	86677196.	86754511.	88388734.	5/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	13246805.	13503738.	1754421.	5/3
PM	3477994.	10888320.	13559402.	2186378.	3964874.	506800.	83810.	14239118.	7937841.	1052174.	1086045.	0.	5/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	1646203.	13540123.	132075.	5/4
PM	0.	6039525.	14205879.	7086390.	1282304.	2360084.	506800.	6241877.	1977865.	0.	0.	0.	5/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	15058724.	14656834.	11358942.	5/5
PM	0.	5292312.	32933401.	29656115.	3022939.	0.	283500.	0.	0.	0.	0.	0.	5/5
AM	0.	0.	0.	0.	0.	0.	0.	0.	195005.	0.	0.	195005.	6/1
PM	195005.	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	6/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	195005.	0.	0.	6/3
PM	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	195005.	0.	6/5
PM	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/5
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/1
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/3
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/7
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/7
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/7
AM	739965.	632872.	517077.	329726.	239125.	266070.	393746.	548368.	873348.	1169844.	1733340.	2346215.	8/7
PM	2708582.	3002317.	3160219.	2817160.	2595082.	1913576.	1321649.	1075442.	1011476.	996258.	1049728.	912564.	8/7
AM	21190.	14512.	9825.	5779.	5522.	4688.	12522.	19842.	23245.	26520.	30437.	38078.	8/8
PM	36794.	37179.	36345.	41546.	39812.	35959.	37436.	40775.	36088.	31914.	29281.	27226.	8/8
AM	0.	0.	0.	0.	0.	0.	12415.	18623.	105531.	186231.	254516.	329008.	8/9
PM	415916.	499720.	558693.	599043.	614562.	620770.	620770.	614562.	543174.	372462.	167608.	0.	8/9

TABLE VI-5. NATIONAL POPULATION FOR SUNDAY

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	50129145.	49514862.	50324752.	49661411.	50562637.	50592232.	50555239.	47958373.	45770803.	37314179.	38730925.	42184270.	1/1
PM	48869424.	42329511.	27344922.	22326152.	33251843.	47094618.	47399435.	49539816.	48509745.	50426825.	50440979.	50495360.	1/1
AM	0.	0.	0.	711660.	0.	0.	0.	2544544.	4545994.	11960969.	9596530.	6003910.	1/3
PM	1233505.	1877119.	558274.	127454.	2665200.	0.	344736.	848468.	1896556.	0.	0.	0.	1/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1318579.	750850.	1/4
PM	0.	909768.	1948858.	2211556.	1667540.	2905880.	2592709.	0.	0.	0.	0.	0.	1/4
AM	0.	711660.	0.	99897.	0.	0.	0.	0.	215880.	1179108.	684799.	1266719.	1/5
PM	0.	4927702.	20129626.	25244146.	12357123.	215880.	0.	0.	0.	0.	0.	0.	1/5
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/1
PM	0.	0.	0.	0.	212713.	0.	0.	0.	0.	0.	0.	0.	2/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/3
PM	0.	0.	212713.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2/5
PM	0.	0.	0.	212713.	0.	0.	0.	0.	0.	0.	0.	0.	2/5
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/1
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/3
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/5
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3/5
AM	88398189.	87015518.	88403339.	86847312.	88405289.	88405667.	88402117.	82923945.	79499741.	63914465.	70791703.	73206787.	5/1
PM	85761072.	75510368.	49219818.	39253396.	56054105.	83163474.	83258265.	87034752.	85992004.	88173418.	88183705.	88220624.	5/1
AM	0.	0.	0.	1388841.	0.	0.	0.	5440332.	8349431.	22215534.	13594792.	11051635.	5/3
PM	2108320.	3402922.	1187820.	201394.	5035675.	0.	681860.	1104662.	2160866.	0.	0.	0.	5/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2183882.	1623694.	5/4
PM	0.	1636635.	3015682.	3819036.	2044025.	4507881.	4164608.	0.	0.	0.	0.	0.	5/4
AM	0.	1388841.	0.	160404.	0.	0.	0.	0.	324386.	1980111.	1463439.	2060135.	5/5
PM	0.	7274005.	34173561.	44273732.	24448306.	324386.	0.	0.	0.	0.	0.	0.	5/5
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/1
PM	0.	0.	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	6/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/3
PM	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/4
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6/5
PM	0.	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	6/5
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/1
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/1
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/3
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/3
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/7
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/4
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/5
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7/5
AM	629630.	533550.	436231.	290131.	199181.	169748.	205220.	253097.	331752.	442570.	631136.	854517.	8/7
PM	1008919.	1122137.	1218473.	1123189.	1088442.	892090.	717496.	627015.	596417.	549778.	527041.	437072.	8/7
AM	13719.	9396.	6361.	3742.	3575.	3035.	8107.	12846.	15050.	17170.	19706.	24653.	8/8
PM	23822.	24071.	23531.	26898.	25776.	23281.	24238.	26399.	23365.	20662.	18958.	17627.	8/8
AM	0.	0.	0.	0.	0.	0.	0.	38798.	116394.	155193.	155193.	155193.	8/9
PM	155193.	155193.	155193.	155193.	116394.	38798.	0.	0.	0.	0.	0.	0.	8/9

TABLE VI-6. EXPLANATION OF NEIGHBORHOOD/MICROENVIRONMENT (N/M) CODES USED IN THIS PROJECT

Neighborhood	No.**
Urban core residential	1
Urban core commercial	2
Urban core industrial	3
Suburban residential	5
Suburban commercial	6
Suburban industrial	7
Mobile source microenvironments (collectively)*	8

Microenvironments	No.**
Indoor	1
Vehicle	3
Roadside	4
Outdoor	5
Street Canyon	7
Tunnel	8
Parking Garage	9

Example: N/M = 5/1 = suburban residential/indoor

*Not a NEM CO Study neighborhood but rather the collective designation for Mobile Source microenvironments.

**Numbers missing were for neighborhood and microenvironments defined in the NEM CO study, but not used in this study.

VII. RURAL EXPOSURE

The NEM neighborhoods and mobile source microenvironments all occur in what the Census Bureau defines as urban areas. Yet the ultimate goal of this project is to define exposure levels for all persons in the U.S., not just those in urban areas. Obviously, some estimates of rural population and pollutant concentrations are required to complete the person hour exposure estimate for the entire country. This brief report section will cover the rural population distribution and pollutant concentrations included as inputs to the person hour exposure computer program in the project.

The Census Bureau lists 366 areas of the country with populations over 50,000 as urban areas. The total population of these 366 areas in 1980 was 139,170,613. For this project, the remaining 87,334,142 people of the total 226,504,755 people in the U.S. were assigned to the rural "neighborhood." Since no detailed study of the rural population was undertaken, there were no further subdivisions of the rural neighborhood into different neighborhood classes or microenvironments. Since the entire rural population was in one N/M type, the hour-by-hour distribution of population in the rural neighborhood consisted of the total rural population every hour of the day.

In general, persons living in rural areas do not experience high concentrations of mobile source pollutants. To estimate the magnitude of total exposure, CO was again used as the indication of mobile source emissions. Background levels of CO range from 0.03 to 0.22 ppm.(22) However, air masses that have recently traversed urban areas show levels as high as 1.0 ppm in rural areas.(22)

A detailed examination of rural exposure to mobile source pollutants was not part of the scope of this study. However, from the data presented above, it is estimated that all rural exposure to CO is below 2 ppm. Using the 1980 mobile source 35 mph emission factor for CO of 15.51 g/min, this 2 ppm CO converts to a mobile source exposure upper limit of 149 $\mu g/m^3$ at 1.0 g/min emission factor. For purposes of this study, it was assumed that 50 percent of the person hour exposure was between 0 and 37 $\mu g/m^3$, 30 percent of the person hour expsure was between 37 and 75 $\mu g/m^3$, 15 percent between 75 and 112 $\mu g/m^3$ and 5 percent between 112 and 149 $\mu g/m^3$. For the 87.3 million people in rural areas, the person hour exposure distribution is then as shown in Table VII-1.

TABLE VII-1. RURAL EXPOSURE TO MOBILE SOURCE POLLUTANTS

Concentration Exceeded g/m^3 (a)	Person Hours (Millions)
0	765,048
37	382,524
75	153,009
112	38,252
149	0

(a)for a 1 g/min emission factor

VIII. PERSON HOUR EXPOSURE COMPUTER PROGRAM

The purpose of this project was to provide a means to estimate national exposure to any mobile source pollutant in terms of a cumulative distribution of person hours of exposure to a range of pollutant concentrations. The technique chosen to calculate the person hours of exposure was based on pollutant concentrations resulting from a one gram per minute emission factor. The person hours of exposure for a pollutant with other than a one gram per minute emission factor can then be obtained by multiplying the pollutant concentrations by the emission factor for that pollutant. This is possible because the emission factor in the mathematical models of pollutant dispersion is simply a multiplier to the complex dispersion equation. Thus, pollutant concentration is directly proportional to emission factor.

Since vehicles can have different emission factors in each of the N/M types for which populations have been estimated and concentration distributions defined, it is necessary to calculate person hours of exposure for each microenvironment separately. Then, using common values of pollutant concentrations for all N/M types, the person hours of exposure in each microenvironment are summed to obtain the total nationwide cumulative person hour exposure distribution. Because of the extensive number of calculations, a computer program was obviously required.

Microenvironment Exposure Model

To calculate only person hours of exposure in a specific microenvironment, no information about the the movement of people from place to place is required. All that is required is the population and concentration distributions, nationwide, for each microenvironment. This approach to calculating person hours of exposure is referred to as "place specific" as contrasted to other models which are considered "people specific" since they follow a group of people through the day.

For a place specific model, the number of people in the microenvironment multiplied by the annual frequency of each pollutant concentration gives the person hours of exposure in the microenvironment for that concentration interval. In this project, hourly population values were used with pollutant concentration ranges appropriate to each microenvironment. Since hourly populations and pollutant concentration levels are different for weekdays, Saturdays and Sundays, three sets of hourly distributions are required. The person hours of exposure are summed for all hours of the day and all day types for the entire year to give the annual person hours of exposure in each microenvironment. The mathematical expression of the model for a single microenvironment and single day type is:

$$P_{kj} = \sum_{i=1}^{24} a_j T_{ij} F_{ijk}$$

Where:

P_{kj} = person hours exposure to concentration interval "k", for day type "j"

T_{ij} = population during hour "i" in the microenvironment on day type "j"

F_{ijk} = Frequency of occurrence of concentration in interval "k" during hour "i" of day type "j"

a_j = number of type "j" days in a year. The number of weekdays per year was taken as (52x5) + 1 = 261. From this number was subtracted 13 holidays, for a total of 248 weekdays. The holidays were further divided into 10 "Saturday type" holidays and 3 "Sunday type." Thus, there were 52 + 10 = 62 "Saturdays," and 52 + 3 = 55 "Sundays."

After calculating the person hours within a given pollutant interval, the person hours in each interval are summed to yield the cumulative frequency distributions for each day type. Next, a common set of pollutant concentration values is chosen for all microenvironments. Each microenvironment cumulative distribution is interpolated to obtain the cumulative person hours of exposure at the common pollutant concentration values. The cumulative person hours at each concentration value are then summed for all microenvironments and day types.

The Computer Program

The computer program written to process the exposure model uses the pollutant concentration frequency distributions developed in Sections II and III of this report and the national microenvironment populations from Section VI. The program allows the determination of person hours of exposure for years other than 1980 by inputing national population values for urban and rural population. Emission factors, in terms of grams per minute, must be input for each NEM neighborhood and each mobile source microenvironment, together with a rural emission factor. Pollution concentration intervals for the output cumulative distribution may be input or, if not input, determined by the computer program. The output of the program is a single cumulative distribution with 25 concentration values in one column and the corresponding number of person hours of exposure to concentrations exceeding those values in a second column. The lowest concentration used by the computer program in the cumulative distributions is zero.

A block diagram of the computer program is shown in Figure VIII-1. The program consists of a main program, two subroutines, one function and five block data routines. The main program, called MOBEX, calculates the multiplier for population other than 1980, calculates the person hours of exposure in each concentration interval for each microenvironment using the algorithm shown above, calculates the cumulative distribution for each microenvironment, sums the person hours for all microenvironments and days, then prints the output. Subroutine CHOPOL chooses the correct concentration frequency distribution depending on the day type and hour of the day. Subroutine CALCIN determined common concentration intervals for all microenvironment cumulative person hour distributions, if the desired concentration intervals are not input. Function FLAGR is the interpolation routine to obtain the person hours exposure in each microenvironment at the common concentration intervals. The block data routines contain the various population and concentration values as shown below:

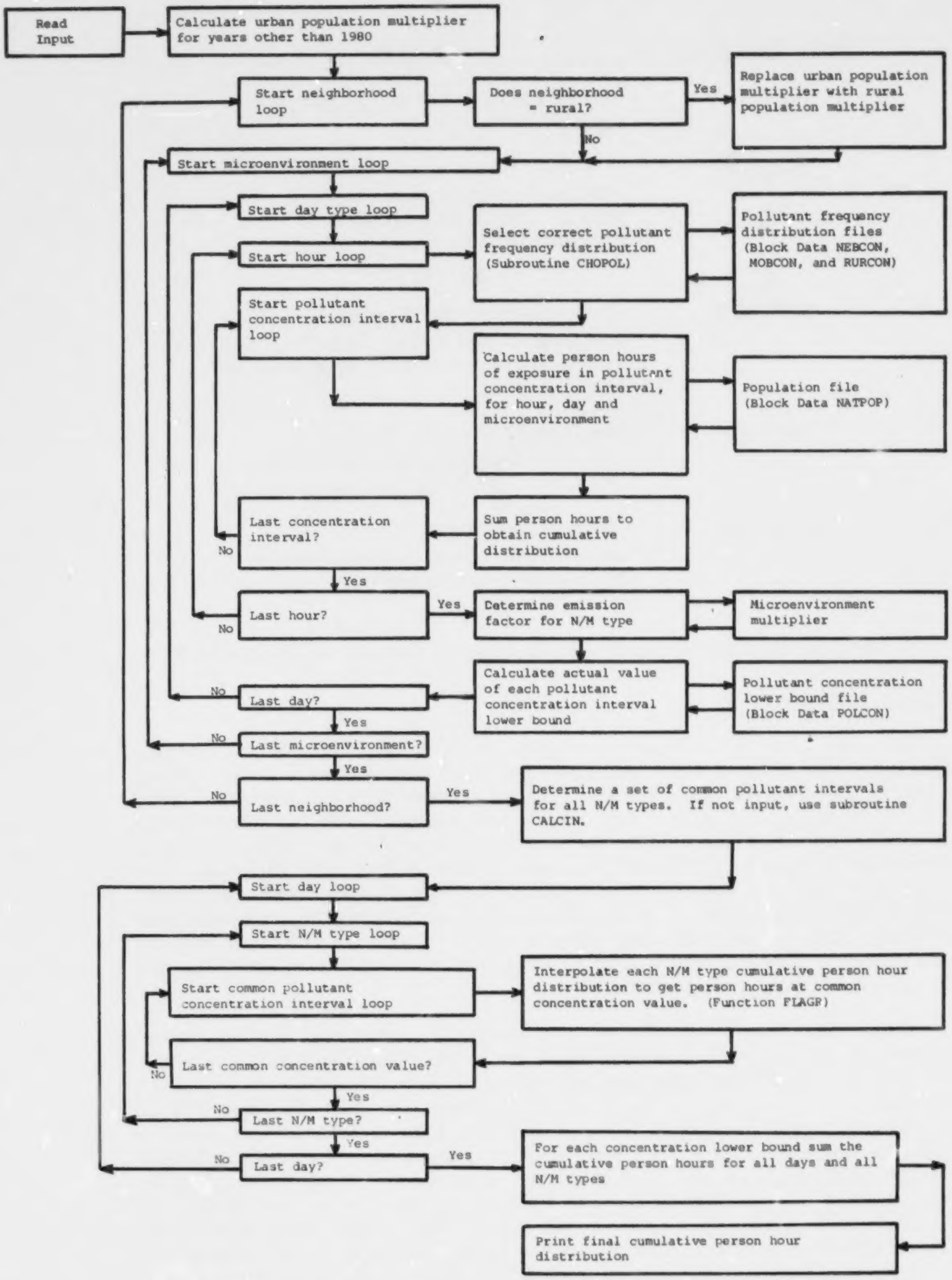
Read Input
Calculate urban population multiplier for years other than 1980
Start neighborhood loop
Does neighborhood = rural?
Yes
Replace urban population multiplier with rural population multiplier
No
Start microenvironment loop
Start day type loop
Start hour loop
Select correct pollutant frequency distribution (Subroutine CHOPOL)
Pollutant frequency distribution files (Block Data NEBCON, MOBCON, and RURCON)
Start pollutant concentration interval loop
Calculate person hours of exposure in pollutant concentration interval, for hour, day and microenvironment
Population file (Block Data NATPOP)
Last concentration interval?
No
Sum person hours to obtain cumulative distribution
Yes
Last hour?
No
Yes
Determine emission factor for N/M type
Microenvironment multiplier
No
Last day?
Yes
Calculate actual value of each pollutant concentration interval lower bound
Pollutant concentration lower bound file (Block Data POLCON)
No
Last microenvironment?
Yes
No
Last neighborhood?
Yes
Determine a set of common pollutant intervals for all N/M types. If not input, use subroutine CALCIN.
Start day loop
Start N/M type loop
Start common pollutant concentration interval loop
Interpolate each N/M type cumulative person hour distribution to get person hours at common concentration value. (Function FLAGR)
Last common concentration value?
No
Yes
No
Last N/M type?
Yes
No
Last day?
Yes
For each concentration lower bound sum the cumulative person hours for all days and all N/M types
Print final cumulative person hour distribution

Figure VIII-1. Block diagram of person hour exposure computer program, MOBEX

Block Data Name	Contents
NATPOP	nationwide hour by hour populations for each N/M type
POLCON	The lower bound values of each pollutant concentration interval for each pollutant frequency distribution in each neighborhood or microenvironment type
NEMCON	The frequency values for each pollutant concentration frequency distribution in each NEM neighborhood type
MOBCON	The frequency values for each concentration frequency distribution in each mobile source microenvironment
RURCON	The frequency values for the concentration frequency distribution for the rural environment.

A complete listing of the computer program is contained in Appendix E.

Computer Program Input

The input to the computer program consists of three or four parts, depending on whether or not the output pollutant distribution interval values are input. The first part is a title line. Up to 40 characters are permitted for a title. Also included in the title line is the name of the pollutant being examined. The second part is the nationwide urban and rural population and a code number to indicate if the pollutant concentration intervals are input. The third part of the input consists of 33 emission factors. For each day type, there is one emission factor for each of the six NEM neighborhoods, one emission factor for each of four different mobile source microenvironments, and an emission factor for rural areas. The fourth (optional) part of the input is a list of 25 pollutant concentration levels.

Table VIII-1 shows the input format and explains the input further. Note that the title line inputs are column dependent. The remaining inputs are order dependent and should be separated by commas. Note also that the emission factors are in terms of grams per minute, not grams per mile. In Table VIII-1, the emission factor remarks list the vehicle cycle or speed that was used to obtain the emission factor that was used to determine each neighborhood's ambient concentrations in the computer program. These same vehicle conditions should be used to determine emission factors for all pollutants. If the pollutant concentration intervals are input, they should begin with zero. The concentration intervals need not be the same increment for all values. In fact, uneven increments are recommended, with the smaller increments at the

TABLE VIII-1. EXPOSURE COMPUTER PROGRAM INPUT

Line	Columns	Input Parameter	Remarks
1	0-40	Title	any desired title up to 40 characters long
1	41-56	Pollutant name	up to 16 characters
2	--	Urban population	population of all urban areas for year under consideration. If year is 1980, may input 0.
2	--	Rural population	Total U.S. population minus the urban population as defined above. If year is 1980, may input 0.
2	--	Pollutant Concentration	0 = program calculates pollutant concentrations 1 = pollutant concentrations are input
3	--	Weekday urban residential neighborhood emission factor in g/min	assumed to be FTP emission factor
3	--	Weekday urban commercial neighborhood emission factor in g/min	assumed to be factor at 10 mph
3	--	Weekday urban industrial neighorhood emission factor in g/min	assumed to be factor at 10 mph
3	--	Weekday suburban residential neighborhood emission factor in g/min	assumed to be FTP emission factor
3	--	Weekday suburban commercial neighborhood emission factor in g/min	assumed to be FTP emission factor
3	--	Weekday suburban industrial neighborhood emission factor in g/min	assumed to be FTP emission factor
3	--	Weekday street canyon emission factor in g/min	assumed to be factor at 10 mph

TABLE VIII-1 CONT'D). EXPOSURE COMPUTER PROGRAM INPUT

Line	Columns	Input Parameter	Remarks
3	--	Weekday tunnel emission factor in g/min	assumed to be factor at 35 mph
3	--	Weekday parking garage emission factor in g/min	assumed to be 0.5 times idle factor plus 0.5 times 10 mph factor, (LDGV only)
3	--	Dummy mobile source emission factor (to allow for future program expansion)	use tunnel factor as dummy
3	--	Weekday rural emission factor in g/min	assumed to be factor at 35 mph
4	--	Saturday urban residential emission factor in g/min	assumed to be 0.72 times weekday FTP factor
4	--	Saturday urban commercial emission factor in g/min	assumed to be 0.72 times 10 mph factor
4	--	Saturday urban industrial emission factor in g/min	assumed to be 0.72 times 10 mph factor
4	--	Saturday suburban residential emission factor in g/min	assumed to be 0.72 times FTP factor
4	--	Saturday suburban commercial emission factor in g/min	assumed to be 0.72 times FTP factor
4	--	Saturday suburban industrial emission factor in g/min	assumed to be 0.72 times FTP factor
4	--	Saturday street canyon emission factor in g/min	assumed to be 0.72 times 10 mph factor
4	--	Saturday tunnel emission factor in g/min	assumed to be factor at 35 mph
4	--	Saturday parking garage emission factor in g/min	assumed to be 0.5 times idle factor plus 0.5 times 10 mph factor (LDGV only)
4	--	Dummy mobile source emission factor (to allow for future program expansion)	use tunnel factor as dummy

TABLE VIII-1 CONT'D). EXPOSURE COMPUTER PROGRAM INPUT

Line	Columns	Input Parameter	Remarks
4	--	Saturday rural emission factor in g/min	assumed to be 0.72 times 35 mph factor
5	--	line 5 contains Sunday emission factors, in the same order as the weekday and Saturday factors	in current version of program Sunday emission factors are equal to Saturday factors
6&7	--	Desired pollutant concentration lower bound values for output pollutant concentration list, 25 values must be input in micrograms/m^3.	This is an optional input. If input, third number in line 2 must equal 1.

lowest concentrations. When the computer program calculates the intervals, the final increment is 20 times the first increment.

An example input is shown in Table VIII-2. This example is for CO. Since the population is for 1980, zero was input for urban and rural populations. The emission factors are the MOBILE3 factors used in Sections II and III of this report to convert the ambient CO distribution. In this example, the output concentration intervals are input.

Computer Program Output

The output of the person hours exposure program is a single page with two columns, each having 25 lines. The left hand column contains the lower bounds of the pollutant concentration intervals. The right hand column contains the cumulative nationwide person hours of exposure at or above each concentration value. A sample output page is shown in Table VIII-3. The person hours of exposure to concentrations of zero and above will be the total nationwide person hours of exposure for a year. For the 1980 population, this value is 1.984×10^{12} person hours (226,504,825 people x 24 hours per day x 365 days/year).

Example Problem

As an example of how to use the computer program, the nationwide exposure to mobile source CO for 1981 was examined. The input values are those shown previously in Table VIII-2. The 1981 CO emission factors are from a computer run of the EPA emission factor program, MOBILE3. The 1981 U.S. population was not available, so the 1980 population was used. For this example, the computer-generated output concentration intervals were used, rather than the concentration intervals shown in Table VIII-2.

The program output is that shown previously in Table VIII-3. Since CO is the pollutant, the concentration in micrograms per cubic meter can be converted to ppm by dividing by 1157, if the more familiar units for CO are desired. The output shows that only about 4.2 percent of the nationwide annual person hours of exposure are at concentrations at or above 350 $\mu g/m^3$ (approximately 3 ppm). Less that one hundredth of one percent of the person hours of exposure occur at concentrations of 350 $\mu g/m^3$ (30 ppm) or above (the one hour NAAQS is 35 ppm). Comparing the computer output with the CO concentration distributions in Sections II and III of this report reveals that any exposure above 77,000 $\mu g/m^3$ could only be from two mobile source microenvironments, tunnels and parking garages. Exposure above 150,000 $\mu g/m^3$ could only be from parking garages.

Comparison of This Study's CO Exposure with the OAQPS NEM CO Study

The CO exposure resulting from the use of the mobile source microenvironments, as was done in this project, cannot be compared directly with CO exposure from the NEM CO analysis done by the EPA OAQPS as presented in Reference 21, since total national exposure was not included in that report. The previous SwRI exposure study did use the NEM computer program to obtain a national exposure estimate. That estimate, as presented in

TABLE VIII-2. EXAMPLE INPUT FOR EXPOSURE COMPUTER PROGRAM

```
TEST RUN NO.  OF EXPOSURE PROGRAM         CO
0,0,0
16.01,15.05,15.05,16.01,16.01,16.01,15.05,15.51,12.15,15.51,15.51
11.53,10.84,10.84,11.53,11.53,11.53,10.84,15.51,12.15,15.51,11.17
11.53,10.84,10.84,11.53,11.53,11.53,10.84,15.51,12.15,15.51,11.17
0,500,1500,3000,4000,5000,6500,7500,9000,11000,12000,13500,14500,
16000,18000,21500,25000,30000,35000,40000,42000,44000,46000,48000,50000
```

TABLE VIII-3. SAMPLE OF EXPOSURE PROGRAM OUTPUT

```
      TEST RUN NO.5 OF EXPOSURE PROGRAM
         POLLUTANT:  CO

EXPOSURE TO                PERSON
CONCENTRATIONS             HOURS
EXCEEDING                  EXPOSURE
(MICROGRAM/CU.M)            (MILLIONS)
----------------            -----------
           0.000            1984405.260
        3500.000              82451.679
        7000.000              19394.141
       10500.000               6326.666
       14000.000               2362.171
       24500.000                452.174
       35000.000                166.296
       45500.000                 89.024
       56000.000                 54.733
       66500.000                 34.776
       77000.000                 22.702
       87500.000                 14.858
       98000.000                  9.499
      108500.000                  6.952
      129500.000                  4.041
      150500.000                  2.929
      192500.000                  1.539
      248500.000                   .823
      304500.000                   .382
      360500.000                   .129
      416500.000                   .010
      486500.000                  0.000
      556500.000                  0.000
      626500.000                  0.000
      696500.000                  0.000
```

Reference 20, shows the highest exposure level to be 60 ppm. There were 0.32×10^6 person hours of exposure at or above 60 ppm. In the current study, with the mobile source microenvironments included, there were approximately 30×10^6 person hours of exposure at or above 60 ppm.

This difference does not imply that the OAQPS study was not correct for the purpose for which it was conducted. The OAQPS study was conducted for an entirely different purpose; namely to investigate exposure at different levels of ambient CO standards. Ambient standards compliance is determined by ambient air monitors, which are specifically sited so as not to be influenced by microscale situations. One of the contentions of the current project is that, in general, mobile source microenvironment concentrations are not directly related to ambient monitor concentration, and thus have little bearing on what the NAAQS for CO should be. The purpose of the present project is to estimate the level of exposure to mobile source pollutants, wherever they are found, to determine if mobile source emissions standards are necessary for any mobile source pollutant in order to protect public health and welfare. Thus, it was proper for the OAQPS study not to include mobile source microenvironments, while it was a necessity that this study include them.

IX. CONCLUSIONS AND RECOMMENDATIONS

This project sought to provide an improved methodology for estimates of annual nationwide exposure to mobile source pollutants.

Improvements Over Past Studies

Improvements to the methodology were made in the following areas.

- A more accurate estimate of hour by hour nationwide population in the various NEM neighborhoods was obtained by using a new technique to extend the four city populations to a national estimate.
- The mobile source microenvironment populations were also subtracted from appropriate neighborhood microenvironment populations.
- The number of CO monitors used to determine the nationwide neighborhood CO concentration distributions was increased by a factor of five.
- Finally, a computer program was written to provide a single nationwide person hour exposure estimate for any mobile source pollutant, when emission factors for that pollutant in each neighborhood type are input.

Limitations and Futher Improvements Needed

As with all estimates, the final values are only as good as the assumptions and data that went into the calculations. This methodology is an improvement over the exposure estimate provided under Contract 68-03-3073, Work Assignment 6. Yet there are still areas in which more data would result in a more accurate estimate of mobile source pollutant exposure.

- One area that could be refined further is the population estimate for the various N/M types. Despite its detail on the city level, the NEM activity pattern procedure does not result in nonzero populations for all N/M types during all hours of the day. A different approach to N/M type population estimates, which would consider nationwide data from new studies of population activity patterns, could provide better hour by hour N/M type population estimates on a national scale.
- A commuter on a crowded expressway was identified in a previous study(18) as an exposure to high mobile source pollutant concentrations. This situation was not included in the mobile source microenvironments, since there is currently insufficient information available to provide the necessary population and pollutant concentration data. The "vehicle" microenvironment in each neighborhood type provides some estimate of the expressway microenvironment, but a better estimate could be obtained by not using the vehicle microenvironment from the six NEM neighborhood types, but instead adding an on-expressway commuting microenvironment to the mobile source microenvironments.

- As could be seen from the example problem in the previous report section, all of the exposure to the highest concentrations was in parking garages. Yet, parking garages have the least-documented estimate of mobile source pollutant concentrations. A project to measure parking garage CO concentrations in a number of locations would do much toward providing a more accurate estimate of all parking garage pollutant concentrations.

Future Work

It is not expected that the improvements outlined above would radically change the overall picture of exposure provided by the methodology presented here. However, if significant health and welfare effects were found for any pollutant at the higher concentrations, then a more accurate estimate would be required for the relatively small number of person hours of exposure that occurs at these higher concentrations. Should more accurate estimates of person hours of exposure to mobile sources be desired, the following additional work is recommended:

1. Develop a new estimate of nationwide population by hour of the day (activity patterns) in the six neighborhood types so that all N/M's have some people in them for all hours of the day.
2. Remove or modify the "vehicle" microenvironment from the six neighborhoods and add an on-expressway mobile source microenvironment.
3. Recalculate the hourly nationwide population in the six neighborhoods by subtracting the new hourly populations in the mobile source microenvironments from the most appropriate N/M's in the six neighborhoods.
4. Conduct a program to measure CO in a variety of parking garages and incorporate these measured values into the exposure computer program.
5. To improve the representativeness of the CO monitor information used, some weighting techniques for the CO readings should be developed to account for monitor city size, altitude, and ambient temperature.
6. Incorporate the findings of the recent EPA studies in Washington and Denver to obtain better adjustments to the fixed CO monitor values for some of the microenvironments.
7. Develop the methodology so that cohort populations could be followed through the day to yield number of persons exposed to given CO levels for different time spans, rather than merely obtaining person hours of exposure.

REFERENCES

1. Springer, K.J., and Ingalls, M.N., "Measurement of Sulfate and Sulfur Dioxide in Automobile Exhaust." Prepared for the Environmental Protection Agency under Contract No. 68-03-2118, EPA 460/3-76-015, August 1976.

2. Dietzmann, H.E., Smith, L.R., Parness, M.A., and Fanick, E.R., "Analytical Procedures for Characterizing Unregulated Pollutant Emissions from Motor Vehicles." Interim Report under Contract No. 68-02-2497 to the Environmental Protection Agency, Publication No. EPA 600/2-79-017, February 1979.

3. Smith, L.R., Parness, M.A., Fanick, E.R., and Dietzmann, H.E., "Analytical Procedures for Characterizing Unregulated Emissions from Vehicles Using Middle-Distillate Fuels." Interim Report to the Environmental Protection Agency under Contract No. 68-02-2497, Report No. EPA 600/2-80-068, April 1980.

4. Springer, K.J., "Investigation of Diesel-Powered Vehicle Emissions VII." Final Report, to the Environmental Protection Agency under Contract 68-03-2116, EPA 460/3-76-034, February 1977.

5. Springer, K.J., "Characterization of Sulfates, Odor, Smoke, POM, and Particulates from Light and Heavy Duty Engines - Part IV." Final Report to the Environmental Protection Agency under Contract No. 68-03-2417, EPA 460/3-79-007, June 1979.

6. Hare, C.T., "Characterization of Gaseous and Particulate Emissions from Light-Duty Diesels Operated on Various Fuels." Final Report to the Environmental Protection Agency under Contract 68-03-2440, EPA 460/3-79-008, July 1979.

7. Smith, L.R., "Characterization of Exhaust Emissions from High Mileage Catalyst-Equipped Automobiles." Final Report to Environmental Protection Agency under Contract 68-03-2884, Task Specifications 7 and 10, EPA 460/3-81-024, September 1981.

8. Smith, L.R., "Unregulated Emissions for Vehicles Operated under Low Speed Conditions." Final Report to the Environmental Protection Agency under Contract 68-03-3073, Work Assignment 4, EPA 460/3-83-006, May 1983.

9. Urban, C.M., "Regulated and Unregulated Exhaust Emissions from Malfunctioning Non-Catalyst and Oxidation Catalyst Gasoline Automobiles." Final Report to the Environmental Protection Agency under Contract No. 86-03-2499, Report No. EPA 460/3-80-003, January 1980.

10. Urban, C.M., "Regulated and Unregulated Exhaust Emissions from Malfunctioning Three-Way Catalyst Gasoline Automobiles." Final Report to the Environmental Protection Agency under Contract 68-03-2588, Report No. EPA 460/3-80-004, January 1980.

11. Urban, C.M., "Regulated and Unregulated Exhaust Emissions from a Malfunctioning Three-Way Catalyst Gasoline Automobile." Final Report to the Environmental Protection Agency under Contract 68-03-2692. Report No. EPA 460/3-80-005, January 1980.

12. Urban, C.M., "Unregulated Exhaust Emissions from Non-Catalyst Baseline Cars Under Malfunction Conditions." Final Report to Environmental Protection Agency under Contract 68-03-2884, Task Specifications 4 and 5, Report No. EPA 460/3-81-020, May 1981.

13. Hare, C.T., "Characterization of Gaseous and Particulate Emissions from Light-Duty Diesels Operated on Various Fuels." Final Report to the Environmental Protection Agency under Contract 68-03-2440, EPA 460/3-79-008, July 1979.

14. Ullman, T.L., and Hare, C.T., "Emissions Characterization of an Alcohol/Diesel-Pilot Fueled Compression-Ignition Engine and Its Heavy-Duty Diesel Counterpart." Final Report to Environmental Protection Agency under Contract 68-03-2884, Task Specification 6, Report No. EPA 460/3-81-023, August 1981.

15. Bykowski, B.B., "Characterization of Diesel Emissions from Operation of a Light-Duty Diesel Vehicle on Alternate Source Diesel Fuels," Final Report to the Environmental Protection Agency under Contract 68-03-2884, Task Specification 3, Report No. EPA 460/3-82-002, November 1981.

16. Ullman, T.L., and Hare, C.T., "Emissions Characterization of a Spark-Ignited, Heavy-Duty, Direct-Injected Methanol Engine." Final Report the Environmental Protection Agency under Contract 68-03-3073, Work Assignment 2, Report No. EPA 460/3-83-003, November 1982.

17. Smith, L.R., Urban, C.R., and Baines, T.M., "Characterization of Exhaust Emissions from Methanol- and Gasoline-Fueled Automobiles." Final Report to the Environmental Protection Agency under Contracts 68-03-2884 and 68-03-3073, Task Specifications 11 and 12, and Work Assignments 1 and 3, Report EPA 460/3-82-004, August 1982.

18. Ingalls, M.N., "Estimating Mobile Source Pollutants in Micorscale Exposure Situation." Final Report to the Environmental Protection Agency under Contract 68-03-2884, Task Specification 1. Report No. EPA 460/3-81-021, July 1981.

19. Harvey, C.A., et al, "A Study of the Potential Impact of Some Unregulated Motor Vehicle Emissions." SAE Paper 830937 presented at the 1983 SAE Passenger Car Meeting, Dearborn, Michigan, June 1983.

20. Ingalls, M.N., "Mobile Source Exposure Estimation." Final Report to the Environmental Protection Agency under Contract 68-03-3073, Work Assignment 6. Report No. EPA 460/3-84-004, March 1984.

21. Johnson, T., and Paul, R.A., "The NAAQS Exposure Model (NEM) Applied to Carbon Monoxide." Draft Final Report by PEDCo Environmental, Inc. for EPA, Contract 68-02-3390, Work Assignments 13 and 16, April 12, 1982, revised June 1982, and December 1982.

22. "Carbon Monoxide," National Research Council, Committee on Medical and Biologic Effect of Environmental Pollutants, National Academy of Sciences, Washington, D.C., 1977.

23. Larsen, R.I., "A New Mathematical Model of Air Pollutant Concentration Averaging Time and Frequency." Journal of the Air Pollution Control Association, Vol. 19, No. 1, January 1969.

24. Larsen, R.I., "A Mathematical Model for Relating Air Quality Measurements to Air Quality Standards," AP-89, Environmental Protection Agency, Research Triangle Park, N.C., November 1971.

25. Mage, D.T., and Ott, W.E., "Refinements of the Lognormal Probability Model for Analysis of Aeormetric Data," APCA Journal Vol. 28, No. 8, August 1978.

26. Johnson, T., "A Comparison of the Two-Parameter Weibull and Lognormal Distributions Fitted to Ambient Ozone Data. Proc. of Specialty Conference on Quality Assurance in Air Pollution Measurement, Air Pollution Control Association, 1979.

27. Aitchison, J., and Brown, J.A.C., The Lognormal Distribution, Cambridge University Press, New York, 1957.

28. Hama, G.M., et al, "Air Flow Requirements for Underground Parking Garages," American Industrial Hygiene Journal, December 1961, pp 462-470.

29. Barker, I.W., and Fox, M.F., "Vehicular Pollution in Car Parks," Royal Society of Health Journal, Vol. 96.

30. Glazer, N., "The Regulation and Control of Carbon Monoxide in Enclosed Parking Garages," APCA Paper 78-4.6, presented at the 71st Annual Meeting of APCA, June 1978.

31. Ayres and Hayakawa, Consulting Engineers, "Project Program Plan and Statement of Probable Costs. Music Center and Mall Garages. Phase I and III." Submitted to County and Los Angeles for Capitol Projects No. 7085.09, 7065.21 and 7065.22, May 1975.

32. Mage, D.T., "Frequency Distributions of Hourly Wind Speed Measurement," Atmospheric Environment, Vol. 14, pp 367-374, 1980.

33. "Airport Climatological Summary." Climatography of United States No. 90, for various airports. National Climatic Center, National Oceanic and Atmospheric Administration, Asheville, N.C.

34. Rodgers, S.J., et al, "Tunnel Ventilation and Air Pollution Treatment," Prepared for FHWA, Office of Research by Mine Safety Appliance Research Corp. Report FHWA-RD-72-15, NTIS No. PB210-360, June 30, 1970.

35. "Study of Air Pollution Aspects of Various Roadway Configurations," Final Report to the New York City Department of Air Resources under Contract 209624 by the General Electric Company, 3198 Chestnut Street, Philadelphia, PA., dated September 1, 1971.

36. Sosslau, A.B., and Hassom, A.B., "Quick-Response Urban Travel Estimation Techniques and Transferrable Parameters," National Cooperative Highway Research Program Report 187. Transportation Research Board, National Research Council, Washington, D.C., 1978.

37. "Short-Range Urban Transit Study, San Antonio, Texas," prepared for the San Antonio Transit System and City of San Antonio by Wilbur Smith and Associates, Houston, Texas, 1972.

38. Thayer, S.D., "Vehicle Behavior In and Around Complex Sources and Related Complex Sources Characteristics, Vol IV--Parking Facilities," Final Report prepared by Goemet, Inc., Rockville, MD, under Contract No. 68-02-1094 Task Orders to the U.S. Environmental Protection Agency, Research Triangle Park, N.C., Publication No. EPA 460/3-74-003d, October 1973.

39. Forrest, L., "Assessment of Environmental Impacts of Light Duty Vehicle Dieselization," Aerospace Report No. ATR-79(7740)-1. Draft Final Report by Aerospace Corporation under Contract DOT-TSC-1530, March 1979.

40. Matson, T.M., Smith, W.S., and Hurd, F.W., Traffic Engineering, McGraw-Hill Book Company, Inc., New York, N.Y., 1955.

41. "Highway Capacity Manual," Highway Research Board Special Report 87, Highway Research Board, National Research Council, Washington, D.C. 1965.

42. "San Antonio-Bexar County Urban Transportation Study Report 6A and 6B - Origin-Destination Survey 1969," Texas Highway Department, Austin, Texas.

43. Schlaug, R.N., and Carlin, T.J., "Aerodynamics and Air Quality Management of Highway Tunnels." Final Report for Contract DOT-FH-11-8538 to Science Applications, Inc. Report FHWA-RD-78-185, January 1980.

44. Homberger, W.S., editor, Transportation and Traffic Engineering Handbook, second edition, Prentice Hall, Inc. Englewood Cliffs, N.J.

45. Curtin, J.F., "Traffic-Transit-Parking in Downtown Rochester: Now to 1975." Contained in Highway Research Board Bulletin 293, Highway Research Board, National Research Council, 1961.

46. Meyer, J.R., Kain, J.F., and Whol, M., The Urban Transportation Problem. Harvard University Press, Cambridge, MA., 1965.

47. Pushkarev, B., and Zupan, J. "Pedestrian Travel Demand," Highway Research Record No. 355, Highway Research Board, National Academy of Sciences, Washington, D.C., 1971.

48. Cameron, R.M., "Mechanical Measurements of Pedestrian Volumes." Transportation Research Record No. 498. Transportation Research Board, National Academy of Sciences, Washington, D.C., 1974.

49. Rutherford, G.S., and Schofer, J.L., "Analysis of Some Characteristics of Pedestrian Travel," Transportation Research Record No. 605. Transportation Research Board, National Academy of Sciences, Washington, D.C, 1976.

APPENDIX A

SUPPORTING INFORMATION FOR CO CONCENTRATIONS IN DIFFERENT NEIGHBORHOODS

TABLE A-1. SAROAD CO MONITORS USED FOR THE URBAN CORE - RESIDENTIAL NEIGHBORHOOD

Monitor No.	City	Monitor Height, ft.	Max. 1 hr. mg/m^3	City Rank	Remarks
262180007F01	Independence, MO (Kansas City)	21	33.4	25	NAMS
060380006F01	Colorado Springs	12	29.9	89	SLAMS
334680004F01	New York (Queens)	95	27.6	1	SLAMS
141220051G01	Chicago		25.9	3	NAMS
231180014G01	Detroit	12	25.7	5	NAMS
173740003F01	Wichita	15	22.0	81	
512200045F01	Milwaukee	15	20.7	23	
056980004I01	San Jose	28	19.6	22	NAMS
010380027G01	Birmingham	13	19.4	42	SLAMS
442340021G01	Memphis	9	17.3	36	NAMS
104360060G01	Tampa	10	17.3	48	SLAMS
381460080F01	Portland	20	16.4	27	NAMS
210120018F01	Baltimore	15	15.6	14	NAMS
142120010F01	East St. Louis	13	15.1	11	
056400003F01	Riverside (L.A. area)	32	15.0	2	NAMS*
372200047F01	Oklahoma City	10	15.0	40	NAMS
192020012F01	New Orleans	10	14.8	26	NAMS
334680010F01	New York	75	14.7	1	SLAMS
220240021F01	Boston	14	11.5	8	SLAMS
482140010F02	Norfolk	10	11.5	37	NAMS
103540019F01	Pensacola	12	11.0	106	SLAMS
		Median	17.3		

Fairly good geographical cross section of urban areas: 7 in NE, 6 in SE, 6 in NW and 2 in SW. Six of top 10 urban areas represented; 18 of top 50. Over half are NAM sites (11 of 21). Seventeen states represented (41% of those with urban areas over 200,000).

*Used in NEM

TABLE A-2. SAROAD CO MONITORS USED FOR THE URBAN CORE - COMMERCIAL NEIGHBORHOOD

Monitor No.	City	Monitor Height, ft.	Max. 1 hr. mg/m^3	City Rank	Remarks
060580002F01	Denver	9	67.5	21	NAMS
053900001I01	Lennox (L.A.)	20	31.1	2	NAMS*
361300014H01	Cleveland	10	28.8	15	NAMS
491840051F01	Seattle	15	26.5	20	SLAMS
152040030F01	Indianapolis	16	25.6	31	NAMS
030860014G01	Tucson	12	24.2	59	NAMS
334680062F01	New York City	10	24.0	1	--
381460002F01	Portland	18	23.8	27	NAMS
442340024G01	Memphis	9	23.6	36	NAMS
397260005G01	Pittsburgh	15	22.3	12	--
220240002A05	Boston	10	21.9	8	--
090020017I01	Washington, DC	34	20.7	7	NAMS
334680005F01	New York City	45	18.9	1	SLAMS
242260047F01	Minneapolis	12	18.4	13	NAMS
052460002I01	Escondido (San Diego)	13	17.3	16	SLAMS
482120006F02	Newport News, VA	16	16.8	78	SLAMS
512200080F01	Milwaukee	12	16.2	23	NAMS
151180011H01	East Chicago, IN	20	16.1	3	SLAMS
361460014F01	Columbus, OH	12	15.0	32	NAMS
055300005I01	Oakland	12	13.8	6	SLAMS
310720007F01	Camden, NJ (Phily)	12	13.3	4	SLAMS
231180016F01	Detroit	12	12.5	5	--
		Median	21.3		

Fair geographical distribution of cities: 12 in NE, 2 in SE, 5 in NW, 3 in SW. Half are NAM sites. Seventeen states represented (41% of those with urban areas over 200,000). Eight of top 10 urban areas represented, 20 of top 50.

*Used in NEM

TABLE A-3. SAROAD CO MONITORS USED FOR THE URBAN CORE - INDUSTRIAL NEIGHBORHOOD

Monitor No.	City	Monitor Height, ft.	Max. 1 hr. mg/m^3	City Rank	Remarks
366600032H01	Toledo	25	22.4	57	--
054180103I01	Los Angeles	36	20.7	2	SLAMS
360060018H01	Akron	12	18.5	50	NAMS
104760001G01	West Palm Beach	12	15.3	56	--
397260026G01	Pittsburgh	25	13.5	12	--
512200040F01	Milwaukee	--	12.1	23	--
056860004I01	San Francisco	20	9.2	6	SLAMS
104360035G02	Tampa	13	8.6	48	NAMS
		Median	14.4		

Eight sites. Fair distribution: 4 in NE, 2 in SE, 1 in NW, 1 in SW. Six states represented. Two of top 10 urban areas, 8 of top 50 urban areas, represented. No other monitors available.

TABLE A-4. SAROAD CO MONITORS USED FOR THE SUBURBAN - RESIDENTIAL NEIGHBORHOOD

Monitor No.	City	Monitor Height, ft.	Max. 1 hr. mg/m^3	City Rank	Remarks
102700019G01	Miami	10	32.2	18	NAMS
060580009F01	Denver	15	31.4	21	NAMS
030600004G01	Phoenix	13	23.0	19	SLAMS
054180105I01	Los Angeles	30	21.9	2	SLAMS
234000001F01	Oak Park (Detroit)	12	21.9	5	SLAMS
340700034G01	Charlotte, NC	14	20.9	74	NAMS
332900005F01	Hempstead (sub. NYC)	15	19.2	1	--
491840078F01	Seattle	11	17.3	20	NAMS
222100003F01	Sommerville (Boston)	14	17.3	8	NAMS
454570036F01	San Antonio	15	16.8	30	NAMS
481850001G01	McLean (D.C. area)	18	16.1	7	SLAMS
051600002I01	Concord, CA (S.F. area)	24	16.1	6	NAMS
397140004H01	Philadelphia	17	16.1	4	--
101960083H01	Jacksonville, FL	12	13.2	44	NAMS
330130002F01	Amherst (Buffalo, NY)	12	12.9	29	SLAMS
140780002G01	Calumet City, IL (Chicago)	15	11.4	3	--
451880003F01	Fort Worth	15	10.9	9	NAMS
452330026F01	Harris Co. (Houston)	14	10.6	10	SLAMS
483240007F01	Virginia Beach, VA (Norfolk)	12	10.1	37	NAMS
051360001I01	Chula Vista, CA (San Diego)	12	9.2	16	NAMS
		Median	16.5		

Good geographical distribution: 7 in NE, 4 in SE, 3 in NW, 6 in SW. Over 50% NAM sites (11 of 20). Fourteen states represented. All urban areas in top 10, and 19 of top 50 represented.

TABLE A-5. SAORAD CO MONITORS USED FOR THE SUBURBAN - COMMERCIAL NEIGHBORHOOD

Monitor No.	City	Monitor Height, ft.	Max. 1 hr. mg/m^3	City Rank	Remarks
030600016G01	Phoenix	10	33.4	19	NAMS
054200001I01	Los Angeles	24	31.1	2	SLAMS
491840075F01	Seattle	11	25.3	20	SLAMS
373000126F02	Tulsa	4	21.6	60	
512200044F01	Milwaukee		21.2	23	NAMS
320040015H02	Albuquerque	4	20.7	62	SLAMS
056580007I01	Sacramento	9	19.6	34	NAMS
101960082H01	Jacksonville, FL	15	19.0	44	SLAMS
482660012F02	Richmond, VA	12	17.8	54	SLAMS
182380019G01	Louisville	15	17.6	38	
231820020F01	Grand Rapids	20	16.4	72	
145680001G01	No. Riverside (Chicago)	15	15.3	3	(used in NEM)
056240001I01	Redwood City (S.F. Bay)	14	13.8	6	SLAMS
222160014F01	Springfield, MA	12	13.8	53	NAMS
030860011G01	Tucson	12	12.9	59	NAMS
361460004F01	Columbus, OH	17	11.5	32	NAMS
364340004H01	Middletown, OH (Cinci)	12	11.5	24	
261040001G01	Clayton (St. Louis)	14	10.0	11	(used in NEM)
102270001G01	Lauderdale Lakes, FL	10	9.8	28	NAMS
056800006I01	San Diego	20	8.1	16	SLAMS
		Median	17.0		

Excellent geographical distribution: 6 in NE, 4 in SE, 5 in NW, 5 in SW. Seven of 20 are NAM sites. Fourteen states represented. Three of the top 10 and 14 of the top [illegible]0 areas represented.

TABLE A-6. SAROAD CO MONITORS USED FOR THE SUBURBAN - INDUSTRIAL NEIGHBORHOOD

Monitor No.	City	Monitor Height, ft.	Max. 1 hr. mg/m^3	City Rank	Remarks
050900002I01	Burbank (L.A.)	15	28.8	2	SLAMS*
011300003G02	Fairfield, AL (Birmingham)	15	16.3	42	
147160005G01	Skokie (Chicago)	39	13.7	3	(used in NEM)
336620014F01	Syracuse, NY	15	12.0	70	
311300004F01	Elizabeth, NJ (near NY)	13	9.8	1	
452560035H01	Houston, TX	4	8.2	10	
391620002F01	Chester, PA (Philadelphia)	7	7.5	4	SLAMS
335680001F01	Rensselear, NY	14	7.0	55	
		Median	11.1		

Eight sites. Poor geographic distribution: 5 in NE, 1 in SE, none in NW, 2 in SW. No NAM sites. Seven states represented. Five in top 10 and 6 in top 50 urban areas. No other monitors available.

*Used in NEM

TABLE A-7. DESCRIPTIVE STATISTICS FOR URBAN RESIDENTIAL NEIGHBORHOOD HOURLY CO READINGS

HOUR ENDING	WEEKDAYS CONCENTRATION,PPM			SATURDAYS CONCENTRATION,PPM			SUNDAYS CONCENTRATION,PPM		
	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM
1	1.05	0.84	19.1	1.29	0.95	13.1	1.27	0.96	13.7
2	0.98	0.80	18.3	1.32	0.96	13.0	1.30	0.96	11.3
3	0.87	0.69	13.0	1.17	0.92	12.3	1.15	0.90	12.9
4	0.81	0.63	22.0	1.04	0.85	10.4	1.04	0.83	10.9
5	0.83	0.70	21.0	0.96	0.78	8.5	0.94	0.75	17.0
6	1.16	0.93	13.0	1.04	0.87	10.0	0.94	0.74	16.0
7	1.81	1.14	21.5	1.16	0.94	10.0	0.97	0.80	13.0
8	2.15	1.43	26.0	1.20	0.95	10.0	0.98	0.85	10.0
9	1.75	1.19	22.3	1.14	0.94	10.1	0.89	0.81	8.0
10	1.30	0.99	13.9	1.02	0.89	10.0	0.84	0.80	11.0
11	1.04	0.92	11.3	0.93	0.86	10.0	0.78	0.76	5.0
12	0.98	0.89	24.0	0.90	0.82	10.0	0.76	0.73	4.0
13	0.95	0.87	22.6	0.87	0.82	6.0	0.74	0.73	4.0
14	0.94	0.88	11.1	0.84	0.81	5.0	0.76	0.75	4.0
15	1.00	0.92	12.2	0.86	0.83	20.0	0.76	0.74	3.5
16	1.14	0.97	10.9	0.91	0.85	27.0	0.79	0.77	7.0
17	1.35	1.01	20.0	0.99	0.89	28.0	0.86	0.82	9.5
18	1.54	1.03	22.5	1.14	0.95	29.0	1.02	0.88	10.5
19	1.47	1.02	22.0	1.31	0.97	22.0	1.13	0.94	8.5
20	1.47	1.01	22.5	1.43	1.00	22.0	1.24	0.96	13.0
21	1.44	1.00	15.7	1.49	1.01	16.0	1.30	0.98	10.7
22	1.44	1.00	14.8	1.54	1.02	16.0	1.29	0.97	11.4
23	1.40	0.99	16.5	1.53	1.02	14.3	1.24	0.97	12.3
24	1.30	0.96	17.0	1.51	1.01	12.8	1.12	0.92	11.9

TABLE A-8. DESCRIPTIVE STATISTICS FOR URBAN COMMERICAL NEIGHBORHOOD HOURLY CO READINGS

HOUR ENDING	WEEKDAYS CONCENTRATION, PPM			SATURDAYS CONCENTRATION, PPM			SUNDAYS CONCENTRATION, PPM		
	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM
1	1.67	1.04	22.0	2.29	1.50	23.0	2.22	1.48	22.0
2	1.36	0.99	20.0	1.97	1.16	22.0	1.94	1.21	18.1
3	1.12	0.91	16.3	1.61	1.02	20.0	1.64	1.03	19.7
4	1.00	0.78	16.3	1.34	0.97	17.0	1.38	0.98	19.9
5	1.07	0.85	14.0	1.19	0.93	15.0	1.20	0.91	17.6
6	1.64	1.03	17.0	1.29	0.97	16.0	1.17	0.92	18.0
7	2.75	1.97	24.0	1.57	1.02	18.0	1.23	0.96	13.4
8	3.66	2.66	27.0	1.78	1.14	15.0	1.27	0.97	10.0
9	3.43	2.47	39.9	1.80	1.26	13.0	1.24	0.98	11.5
10	2.78	2.02	18.1	1.72	1.24	14.5	1.23	0.99	8.2
11	2.41	1.89	19.0	1.72	1.27	15.7	1.25	0.99	8.0
12	2.34	1.77	16.1	1.74	1.20	20.9	1.27	0.99	8.4
13	2.29	1.65	19.7	1.70	1.10	17.3	1.34	1.00	9.0
14	2.25	1.67	16.5	1.70	1.14	13.0	1.38	1.01	8.6
15	2.42	1.95	13.9	1.72	1.11	11.1	1.41	1.01	11.2
16	2.72	2.00	17.2	1.77	1.18	11.8	1.50	1.02	11.5
17	3.07	2.04	39.2	1.80	1.25	13.3	1.56	1.02	10.4
18	3.02	2.01	58.7	1.87	1.30	24.3	1.67	1.04	11.2
19	2.43	1.80	55.0	1.96	1.48	17.3	1.76	1.15	16.4
20	2.26	1.70	41.9	2.15	1.54	23.7	1.85	1.29	18.4
21	2.22	1.66	27.5	2.23	1.65	16.0	1.91	1.36	16.5
22	2.25	1.64	25.2	2.38	1.76	17.5	1.97	1.33	12.9
23	2.20	1.54	25.7	2.48	1.85	20.0	1.88	1.22	13.9
24	2.09	1.48	23.0	2.45	1.85	22.3	1.81	1.15	13.0

TABLE A-9. DESCRIPTIVE STATISTICS FOR URBAN INDUSTRIAL NEIGHBORHOOD HOURLY CO READINGS

HOUR ENDING	WEEKDAYS CONCENTRATION,PPM			SATURDAYS CONCENTRATION,PPM			SUNDAYS CONCENTRATION,PPM		
	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM
1	1.14	0.83	11.0	1.44	0.98	11.0	1.40	0.99	10.0
2	1.07	0.73	10.0	1.46	0.96	12.0	1.32	0.96	10.0
3	0.81	0.55	7.0	1.04	0.82	7.5	1.10	0.80	13.3
4	0.87	0.55	9.0	1.13	0.76	12.0	1.15	0.72	8.2
5	0.88	0.55	10.0	1.01	0.65	10.0	1.03	0.61	7.0
6	1.08	0.71	10.0	0.98	0.62	9.0	0.99	0.60	8.5
7	1.60	1.03	11.2	1.14	0.82	9.0	1.03	0.65	8.0
8	2.00	1.37	19.5	1.21	0.96	9.0	1.04	0.77	9.0
9	1.91	1.42	14.0	1.23	0.96	9.0	1.02	0.84	8.0
10	1.59	1.13	15.0	1.17	0.99	8.0	0.99	0.94	7.0
11	1.38	1.03	16.0	1.13	0.97	10.0	0.95	0.95	9.0
12	1.27	1.02	13.0	1.06	0.96	7.0	0.91	0.95	10.0
13	1.21	1.01	9.0	1.04	0.97	6.0	0.88	0.91	8.0
14	1.16	1.00	9.0	1.00	0.97	7.0	0.86	0.95	7.0
15	1.20	1.00	14.0	0.98	0.98	4.0	0.84	0.93	5.0
16	1.37	1.03	9.5	1.02	0.98	4.0	0.84	0.94	4.0
17	1.53	1.05	12.0	1.04	0.98	4.3	0.87	0.95	4.2
18	1.51	1.04	13.0	1.09	0.99	7.0	0.95	0.96	6.0
19	1.40	1.01	16.0	1.20	1.00	8.0	1.06	0.97	8.0
20	1.40	1.01	18.0	1.33	1.00	10.0	1.15	0.98	8.0
21	1.41	1.01	18.0	1.36	1.01	10.3	1.23	0.99	7.0
22	1.42	1.01	17.0	1.44	1.00	14.3	1.23	0.99	8.0
23	1.40	0.99	16.0	1.49	1.01	16.1	1.23	0.98	8.0
24	1.36	0.98	13.0	1.46	1.01	10.0	1.18	0.95	9.0

TABLE A-10. DESCRIPTIVE STATISTICS FOR SUBURBAN RESIDENTIAL NEIGHBORHOOD HOURLY CO READINGS

HOUR ENDING	WEEKDAYS CONCENTRATION, PPM			SATURDAYS CONCENTRATION, PPM			SUNDAYS CONCENTRATION, PPM		
	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM
1	1.02	0.67	26.5	1.29	0.96	15.3	1.25	0.97	11.6
2	0.94	0.55	23.5	1.24	0.89	17.9	1.23	0.96	13.3
3	0.85	0.52	21.0	1.13	0.75	13.0	1.15	0.81	12.9
4	0.77	0.50	16.0	1.00	0.57	11.0	1.02	0.68	11.3
5	0.76	0.51	12.0	0.90	0.54	10.0	0.90	0.55	9.8
6	1.03	0.95	13.0	0.91	0.60	10.0	0.86	0.55	8.0
7	1.67	1.03	14.0	1.08	0.93	10.0	0.88	0.62	8.0
8	2.17	1.45	22.0	1.21	0.97	11.5	0.93	0.68	8.0
9	1.94	1.04	28.0	1.15	0.96	13.0	0.85	0.68	9.0
10	1.38	0.99	21.0	1.00	0.81	12.2	0.77	0.61	9.0
11	1.07	0.95	16.0	0.89	0.76	14.0	0.72	0.54	6.0
12	0.92	0.82	13.0	0.83	0.73	11.1	0.69	0.53	5.0
13	0.85	0.74	13.0	0.77	0.60	10.4	0.69	0.54	5.0
14	0.81	0.69	10.0	0.74	0.57	8.6	0.67	0.53	5.0
15	0.83	0.77	7.0	0.71	0.58	7.3	0.66	0.53	5.0
16	0.89	0.86	7.0	0.71	0.57	6.7	0.65	0.53	5.0
17	1.03	0.96	13.0	0.75	0.63	5.7	0.68	0.53	5.0
18	1.22	0.98	18.8	0.89	0.81	6.3	0.83	0.68	11.5
19	1.38	0.99	24.3	1.14	0.97	10.0	1.03	0.90	13.0
20	1.48	1.00	27.3	1.33	0.99	11.0	1.21	0.97	10.0
21	0.00	0.00	00.0	1.47	1.00	13.0	1.34	0.98	11.0
22	1.46	1.00	24.6	1.51	1.00	14.0	1.32	0.98	11.0
23	1.43	0.99	24.6	1.52	1.00	13.9	1.29	0.97	11.0
24	1.29	0.97	23.4	1.45	0.99	14.6	1.19	0.93	11.0

TABLE A-11. DESCRIPTIVE STATISTICS FOR SUBURBAN COMMERCIAL NEIGHBORHOOD HOURLY CO READINGS

HOUR ENDING	WEEKDAYS CONCENTRATION, PPM			SATURDAYS CONCENTRATION, PPM			SUNDAYS CONCENTRATION, PPM		
	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM
1	1.48	0.99	22.0	2.01	1.04	21.0	1.89	1.03	17.0
2	1.16	0.95	18.0	1.67	1.01	20.0	1.63	1.01	19.0
3	1.02	0.73	19.0	1.51	0.99	20.0	1.49	0.99	17.0
4	0.92	0.58	18.4	1.27	0.96	16.0	1.29	0.97	16.0
5	0.91	0.66	17.0	1.10	0.79	16.0	1.07	0.80	13.0
6	1.23	0.98	16.0	1.15	0.96	14.0	1.02	0.85	11.0
7	2.07	1.47	16.0	1.35	1.00	13.0	1.09	0.96	10.5
8	2.85	2.00	26.0	1.48	1.02	15.0	1.09	0.97	10.0
9	2.50	1.75	29.0	1.49	1.02	12.0	1.02	0.97	7.5
10	1.83	1.07	17.0	1.42	1.02	11.0	1.02	0.98	7.0
11	1.55	1.03	14.0	1.37	1.02	8.0	1.00	0.97	8.0
12	1.48	1.03	13.0	1.39	1.03	8.0	1.00	0.98	7.0
13	1.43	1.02	14.0	1.39	1.02	10.0	1.09	0.99	8.0
14	1.40	1.02	13.9	1.37	1.02	13.0	1.04	0.98	8.0
15	1.46	1.03	15.3	1.39	1.02	11.0	1.01	0.98	8.0
16	1.66	1.05	15.0	1.38	1.02	11.5	1.02	0.98	11.0
17	1.91	1.43	17.0	1.43	1.02	15.0	1.10	0.98	11.0
18	2.06	1.49	19.0	1.60	1.03	12.0	1.29	1.00	9.0
19	2.07	1.43	22.0	1.80	1.04	16.0	1.45	1.02	10.0
20	2.12	1.46	22.0	1.98	1.15	14.0	1.62	1.03	15.0
21	2.11	1.34	26.0	2.08	1.31	18.0	1.69	1.03	17.0
22	2.11	1.20	26.0	2.13	1.30	18.0	1.76	1.04	19.0
23	1.95	1.04	27.0	2.13	1.24	20.0	1.73	1.02	19.0
24	1.77	1.02	25.0	2.02	1.05	21.0	1.55	1.00	18.0

TABLE A-12. DESCRIPTIVE STATISTICS FOR SUBURBAN INDUSTRIAL NEIGHBORHOOD HOURLY CO READINGS

HOUR ENDING	WEEKDAYS CONCENTRATION,PPM			SATURDAYS CONCENTRATION,PPM			SUNDAYS CONCENTRATION,PPM		
	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM	MEAN	MEDIAN	MAXIMUM
1	1.35	0.70	17.0	1.76	0.92	20.0	1.76	0.80	16.0
2	1.03	0.58	16.0	1.30	0.76	13.0	1.34	0.72	11.0
3	1.17	0.60	16.0	1.57	0.75	18.0	1.56	0.73	14.0
4	1.14	0.57	15.0	1.48	0.68	16.0	1.44	0.65	14.0
5	1.13	0.57	14.0	1.40	0.63	15.0	1.33	0.62	14.0
6	1.34	0.71	13.0	1.41	0.66	13.0	1.27	0.62	12.0
7	1.86	1.00	15.0	1.49	0.73	13.0	1.29	0.63	11.0
8	2.15	1.22	19.0	1.47	0.83	12.0	1.27	0.68	11.0
9	1.96	1.15	17.0	1.40	0.85	12.0	1.15	0.68	9.0
10	1.58	0.97	14.0	1.20	0.78	10.0	0.96	0.66	9.0
11	1.31	0.82	12.0	1.07	0.74	10.0	0.83	0.58	7.0
12	1.19	0.74	12.0	0.99	0.65	10.0	0.77	0.56	6.0
13	1.05	0.69	11.0	0.94	0.62	10.0	0.79	0.55	14.2
14	1.00	0.67	11.0	0.86	0.58	10.0	0.77	0.52	14.1
15	0.94	0.62	12.0	0.84	0.60	10.0	0.73	0.50	12.3
16	0.99	0.65	12.0	0.80	0.58	4.0	0.70	0.50	6.0
17	1.11	0.70	13.0	0.88	0.62	5.0	0.75	0.54	6.0
18	1.26	0.81	18.0	1.03	0.67	8.0	0.89	0.59	7.0
19	1.38	0.81	20.0	1.19	0.81	9.0	1.07	0.69	10.0
20	1.48	0.81	24.0	1.41	0.94	11.0	1.24	0.81	12.0
21	1.56	0.85	23.0	1.56	0.90	12.0	1.30	0.79	12.0
22	1.60	0.86	25.0	1.71	0.94	14.0	1.35	0.81	12.0
23	1.62	0.86	22.0	1.81	0.95	16.0	1.39	0.78	13.0
24	1.56	0.81	21.0	1.88	0.96	15.0	1.37	0.73	14.0

TABLE A-13. FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR WEEKDAYS

URBAN RESIDENTIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-5AM	6AM	7-10AM	11AM-3PM	4-6PM	7PM-MID	DAY TYPE
0	.4280	.3140	.1770	.3280	.2300	.2480	WKD
36	.4330	.4540	.4410	.4810	.4310	.4550	WKD
109	.0830	.1330	.1930	.1390	.1970	.1660	WKD
180	.0310	.0610	.0820	.0370	.0740	.0620	WKD
253	.0120	.0220	.0390	.0080	.0270	.0280	WKD
325	.0060	.0090	.0250	.0030	.0140	.0160	WKD
398	.0030	.0050	.0150	.0010	.0060	.0090	WKD
470	.0010	.0020	.0090	.0010	.0030	.0050	WKD
541	.0010	.0010	.0050	.0002	.0030	.0040	WKD
614	.0003	.0002	.0040	.0001	.0010	.0020	WKD
686	.0004	.0004	.0040	.0001	.0010	.0010	WKD
759	.0003	.0000	.0020	.0001	.0010	.0010	WKD
831	.0001	.0000	.0010	.0000	.0010	.0010	WKD
904	.0002	.0002	.0010	.0000	.0004	.0004	WKD
975	.0000	.0000	.0010	.0000	.0010	.0004	WKD
1120	.0001	.0000	.0010	.0000	.0010	.0002	WKD
1337	.0001	.0000	.0002	.0000	.0004	.0000	WKD
1554	.0000	.0000	.0001	.0001	.0001	.0001	WKD
1770	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2132	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2150	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2175	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2200	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2225	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2250	.0000	.0000	.0000	.0000	.0000	.0000	WKD

URBAN COMMERCIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-5AM	6AM	7-10AM	11AM-2PM	3-6PM	7PM-MID	DAY TYPE
0	.3440	.2500	.0810	.1070	.0760	.1190	WKD
38	.4220	.4080	.2820	.3700	.3250	.3700	WKD
116	.1290	.1470	.1980	.2020	.2130	.2210	WKD
192	.0520	.0860	.1270	.1160	.1260	.1210	WKD
270	.0220	.0490	.0900	.0810	.0820	.0670	WKD
346	.0120	.0250	.0620	.0500	.0550	.0370	WKD
422	.0060	.0120	.0450	.0320	.0400	.0230	WKD
500	.0040	.0090	.0340	.0190	.0280	.0140	WKD
576	.0020	.0050	.0260	.0110	.0190	.0090	WKD
654	.0020	.0030	.0150	.0060	.0110	.0050	WKD
730	.0020	.0030	.0130	.0040	.0080	.0040	WKD
808	.0010	.0004	.0080	.0020	.0050	.0030	WKD
884	.0010	.0010	.0060	.0010	.0040	.0020	WKD
961	.0003	.0010	.0040	.0004	.0030	.0010	WKD
1038	.0010	.0002	.0050	.0010	.0030	.0020	WKD
1192	.0003	.0010	.0040	.0002	.0010	.0010	WKD
1422	.0001	.0000	.0010	.0001	.0010	.0010	WKD
1653	.0001	.0000	.0003	.0000	.0004	.0003	WKD
1884	.0000	.0000	.0002	.0000	.0001	.0002	WKD
2268	.0000	.0000	.0001	.0000	.0004	.0002	WKD
2300	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2325	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2350	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2375	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2400	.0000	.0000	.0000	.0000	.0000	.0000	WKD

TABLE A-13 (CONT'D). FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR WEEKDAYS

URBAN INDUSTRIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-6AM	7AM	8-9AM	10AM-4PM	5-6PM	7PM-MID	DAY TYPE
0	.4550	.2570	.1870	.2830	.2510	.2670	WKD
38	.3690	.3970	.3550	.3900	.3790	.4580	WKD
116	.0920	.1760	.2140	.2180	.2110	.1560	WKD
192	.0420	.0670	.1120	.0710	.0840	.0540	WKD
270	.0200	.0370	.0530	.0190	.0370	.0240	WKD
346	.0110	.0220	.0290	.0090	.0200	.0120	WKD
422	.0070	.0140	.0150	.0040	.0100	.0080	WKD
500	.0020	.0160	.0130	.0030	.0030	.0070	WKD
576	.0010	.0060	.0060	.0010	.0020	.0040	WKD
654	.0020	.0040	.0060	.0010	.0010	.0030	WKD
730	.0010	.0020	.0020	.0010	.0010	.0020	WKD
808	.0003	.0020	.0030	.0001	.0010	.0020	WKD
884	.0000	.0000	.0020	.0001	.0003	.0010	WKD
961	.0000	.0000	.0020	.0001	.0003	.0010	WKD
1038	.0000	.0000	.0010	.0002	.0000	.0010	WKD
1192	.0000	.0000	.0003	.0001	.0000	.0010	WKD
1422	.0000	.0000	.0003	.0000	.0000	.0000	WKD
1653	.0000	.0000	.0000	.0000	.0000	.0000	WKD
1884	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2268	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2300	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2325	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2350	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2375	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2400	.0000	.0000	.0000	.0000	.0000	.0000	WKD

SUBURBAN RESIDENTIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-5AM	6AM	7-10AM	11AM-3PM	4-6PM	7PM-MID	DAY TYPE
0	.5280	.3980	.2240	.4300	.3510	.3120	WKD
36	.3320	.4150	.4080	.4260	.4290	.4140	WKD
109	.0780	.1120	.1730	.0990	.1320	.1370	WKD
180	.0290	.0440	.0770	.0290	.0500	.0600	WKD
253	.0120	.0170	.0420	.0080	.0200	.0280	WKD
325	.0090	.0080	.0240	.0040	.0090	.0170	WKD
398	.0040	.0030	.0150	.0010	.0030	.0100	WKD
470	.0030	.0020	.0120	.0010	.0020	.0070	WKD
541	.0020	.0010	.0080	.0010	.0010	.0040	WKD
614	.0010	.0004	.0050	.0001	.0010	.0030	WKD
686	.0010	.0004	.0040	.0002	.0002	.0020	WKD
759	.0004	.0000	.0030	.0001	.0003	.0020	WKD
831	.0004	.0002	.0020	.0001	.0004	.0020	WKD
904	.0003	.0002	.0020	.0002	.0003	.0010	WKD
975	.0003	.0000	.0020	.0001	.0000	.0010	WKD
1120	.0001	.0000	.0010	.0001	.0001	.0010	WKD
1337	.0001	.0000	.0003	.0000	.0001	.0001	WKD
1554	.0001	.0000	.0001	.0000	.0000	.0002	WKD
1770	.0001	.0000	.0001	.0000	.0000	.0002	WKD
2132	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2150	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2175	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2200	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2225	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2250	.0000	.0000	.0000	.0000	.0000	.0000	WKD

TABLE A-13 (CONT'D). FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR WEEKDAYS

SUBURBAN COMMERCIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1AM	2-5AM	6AM	7-10AM	11AM-3PM	4PM-MID	DAY TYPE
0	.3330	.4610	.3230	.1540	.2270	.1900	WKD
36	.3950	.3670	.4380	.3440	.4160	.3740	WKD
109	.1290	.0920	.1220	.1990	.2110	.2030	WKD
180	.0520	.0320	.0550	.1150	.0800	.0960	WKD
253	.0280	.0160	.0260	.0650	.0340	.0510	WKD
325	.0140	.0090	.0160	.0390	.0160	.0280	WKD
398	.0120	.0080	.0070	.0240	.0080	.0180	WKD
470	.0080	.0040	.0050	.0160	.0030	.0120	WKD
541	.0060	.0040	.0030	.0100	.0020	.0080	WKD
614	.0040	.0030	.0020	.0090	.0010	.0050	WKD
686	.0040	.0010	.0005	.0070	.0004	.0040	WKD
759	.0040	.0010	.0005	.0040	.0004	.0030	WKD
831	.0030	.0010	.0010	.0030	.0002	.0030	WKD
904	.0030	.0004	.0000	.0020	.0002	.0020	WKD
975	.0010	.0010	.0002	.0030	.0002	.0030	WKD
1120	.0020	.0004	.0002	.0020	.0000	.0020	WKD
1337	.0002	.0001	.0000	.0010	.0000	.0010	WKD
1554	.0002	.0000	.0000	.0004	.0000	.0003	WKD
1770	.0000	.0000	.0000	.0002	.0000	.0001	WKD
2132	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2150	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2175	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2200	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2225	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2250	.0000	.0000	.0000	.0000	.0000	.0000	WKD

SUBURBAN INDUSTRIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1AM	2-5AM	7AM	8-10AM	11AM-4PM	5PM-MID	DAY TYPE
0	.3880	.4550	.2310	.2090	.3940	.3280	WKD
36	.3740	.3550	.4300	.4200	.4010	.3980	WKD
109	.1100	.0780	.1370	.1720	.1150	.1360	WKD
180	.0460	.0430	.0530	.0730	.0510	.0600	WKD
253	.0290	.0220	.0480	.0350	.0190	.0280	WKD
325	.0110	.0120	.0220	.0250	.0090	.0130	WKD
398	.0080	.0120	.0210	.0120	.0040	.0090	WKD
470	.0070	.0060	.0160	.0100	.0020	.0080	WKD
541	.0080	.0050	.0140	.0110	.0010	.0040	WKD
614	.0050	.0040	.0090	.0060	.0010	.0030	WKD
686	.0060	.0040	.0110	.0090	.0020	.0030	WKD
759	.0020	.0010	.0030	.0030	.0003	.0020	WKD
831	.0000	.0010	.0020	.0040	.0004	.0020	WKD
904	.0030	.0004	.0020	.0030	.0000	.0020	WKD
975	.0030	.0010	.0010	.0040	.0000	.0010	WKD
1120	.0010	.0003	.0000	.0020	.0000	.0020	WKD
1337	.0000	.0000	.0000	.0004	.0000	.0010	WKD
1554	.0000	.0000	.0000	.0000	.0000	.0002	WKD
1770	.0000	.0000	.0000	.0000	.0000	.0001	WKD
2132	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2150	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2175	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2200	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2225	.0000	.0000	.0000	.0000	.0000	.0000	WKD
2250	.0000	.0000	.0000	.0000	.0000	.0000	WKD

TABLE A-14. FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR SATURDAYS

URBAN RESIDENTIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-2AM	3-6AM	7-9AM	10AM-NOON	1-6PM	7PM-MID	DAY TYPE
0	.2940	.3640	.2740	.3390	.3530	.2940	SAT
50	.4570	.4600	.5120	.5140	.5130	.4570	SAT
152	.1340	.0980	.1270	.1100	.1000	.1340	SAT
250	.0540	.0390	.0480	.0200	.0200	.0540	SAT
352	.0240	.0200	.0170	.0090	.0070	.0240	SAT
452	.0110	.0070	.0100	.0040	.0030	.0110	SAT
553	.0070	.0050	.0050	.0010	.0010	.0070	SAT
653	.0050	.0030	.0020	.0010	.0010	.0050	SAT
752	.0030	.0020	.0030	.0010	.0000	.0030	SAT
853	.0030	.0010	.0003	.0000	.0003	.0030	SAT
954	.0040	.0010	.0010	.0010	.0002	.0040	SAT
1055	.0010	.0003	.0000	.0000	.0003	.0010	SAT
1151	.0010	.0001	.0000	.0000	.0002	.0010	SAT
1257	.0010	.0000	.0000	.0000	.0000	.0010	SAT
1355	.0000	.0000	.0000	.0000	.0002	.0000	SAT
1557	.0000	.0000	.0000	.0000	.0000	.0000	SAT
1858	.0000	.0000	.0000	.0000	.0002	.0000	SAT
2160	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2460	.0000	.0000	.0000	.0000	.0010	.0000	SAT
2963	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2989	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3023	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3058	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3093	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3128	.0000	.0000	.0000	.0000	.0000	.0000	SAT

URBAN COMMERCIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1AM	2-6AM	7AM	8AM-2PM	3-6PM	7PM-MID	DAY TYPE
0	.1440	.2900	.2430	.1700	.1600	.1240	SAT
53	.3710	.4180	.4400	.4370	.4390	.3590	SAT
161	.1750	.1390	.1500	.2030	.2040	.2260	SAT
267	.1150	.0740	.0820	.0860	.0810	.1120	SAT
375	.0700	.0310	.0330	.0450	.0550	.0690	SAT
481	.0460	.0150	.0210	.0250	.0240	.0390	SAT
587	.0330	.0130	.0090	.0140	.0120	.0210	SAT
695	.0130	.0050	.0090	.0090	.0090	.0190	SAT
801	.0120	.0060	.0070	.0040	.0070	.0090	SAT
909	.0010	.0020	.0000	.0020	.0040	.0060	SAT
1015	.0020	.0020	.0000	.0010	.0020	.0060	SAT
1123	.0060	.0010	.0010	.0010	.0010	.0030	SAT
1229	.0020	.0010	.0020	.0004	.0010	.0020	SAT
1336	.0040	.0010	.0010	.0010	.0010	.0010	SAT
1443	.0020	.0010	.0000	.0010	.0000	.0010	SAT
1657	.0010	.0010	.0020	.0003	.0000	.0010	SAT
1977	.0000	.0002	.0000	.0001	.0000	.0010	SAT
2298	.0010	.0002	.0000	.0000	.0003	.0010	SAT
2619	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3153	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3197	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3232	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3267	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3301	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3336	.0000	.0000	.0000	.0000	.0000	.0000	SAT

TABLE A-14 (CONT'D). FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR SATURDAYS

URBAN INDUSTRIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1AM	2-4AM	5-6AM	7AM-2PM	3-5PM	6PM-MID	DAY TYPE
0	.3330	.3850	.4640	.3320	.2980	.2580	SAT
53	.3830	.4020	.3480	.4520	.5260	.4870	SAT
161	.1390	.0960	.0920	.1310	.1300	.1470	SAT.
267	.0460	.0530	.0490	.0510	.0340	.0530	SAT
375	.0370	.0210	.0290	.0180	.0120	.0180	SAT
481	.0280	.0150	.0060	.0050	.0000	.0130	SAT
587	.0090	.0100	.0000	.0040	.0000	.0090	SAT
695	.0090	.0060	.0050	.0020	.0000	.0050	SAT
801	.0060	.0050	.0030	.0020	.0000	.0040	SAT
909	.0030	.0010	.0020	.0020	.0000	.0020	SAT
1015	.0030	.0020	.0030	.0004	.0000	.0030	SAT
1123	.0030	.0010	.0000	.0000	.0000	.0000	SAT
1229	.0000	.0020	.0000	.0000	.0000	.0000	SAT
1336	.0000	.0000	.0000	.0000	.0000	.0000	SAT
1443	.0000	.0000	.0000	.0000	.0000	.0004	SAT
1657	.0000	.0000	.0000	.0000	.0000	.0004	SAT
1977	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2298	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2619	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3153	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3197	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3232	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3267	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3301	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3336	.0000	.0000	.0000	.0000	.0000	.0000	SAT

SUBURBAN RESIDENTIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-2AM	3-6AM	7-NOON	1-5PM	6PM	7PM-MID	DAY TYPE
0	.3910	.4860	.4040	.4880	.4140	.2960	SAT
50	.3760	.3380	.4260	.4130	.4380	.4300	SAT
152	.1130	.0940	.1030	.0790	.1030	.1420	SAT
250	.0450	.0400	.0310	.0150	.0300	.0580	SAT
352	.0300	.0130	.0130	.0020	.0070	.0270	SAT
452	.0170	.0110	.0070	.0010	.0050	.0160	SAT
553	.0090	.0050	.0060	.0002	.0030	.0100	SAT
653	.0050	.0060	.0040	.0004	.0000	.0060	SAT
752	.0030	.0030	.0020	.0000	.0000	.0050	SAT
853	.0010	.0020	.0010	.0002	.0000	.0040	SAT
954	.0030	.0020	.0010	.0004	.0000	.0020	SAT
1055	.0020	.0010	.0010	.0000	.0000	.0010	SAT
1151	.0010	.0003	.0010	.0000	.0000	.0010	SAT
1257	.0010	.0003	.0002	.0000	.0000	.0010	SAT
1355	.0030	.0000	.0002	.0000	.0000	.0010	SAT
1557	.0010	.0000	.0000	.0000	.0000	.0000	SAT
1858	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2160	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2460	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2963	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2989	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3023	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3058	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3093	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3128	.0000	.0000	.0000	.0000	.0000	.0000	SAT

TABLE A-14 (CONT'D). FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR SATURDAYS

SUBURBAN COMMERCIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-3AM	4-6AM	7AM	8AM-2PM	3-6PM	7PM-MID	DAY TYPE
0	.2810	.4230	.3120	.2370	.2250	.1910	SAT
50	.3770	.3660	.4090	.4290	.4510	.3720	SAT
152	.1490	.0970	.1530	.2110	.1980	.1940	SAT
250	.0750	.0470	.0510	.0650	.0580	.0960	SAT
352	.0470	.0270	.0290	.0240	.0260	.0520	SAT
452	.0210	.0110	.0180	.0130	.0130	.0290	SAT
553	.0130	.0070	.0060	.0070	.0120	.0180	SAT
653	.0100	.0040	.0040	.0050	.0070	.0130	SAT
752	.0060	.0020	.0060	.0030	.0050	.0130	SAT
853	.0020	.0050	.0050	.0020	.0020	.0060	SAT
954	.0020	.0020	.0050	.0020	.0000	.0050	SAT
1055	.0020	.0020	.0000	.0010	.0020	.0030	SAT
1151	.0040	.0010	.0000	.0002	.0010	.0020	SAT
1257	.0020	.0010	.0010	.0003	.0000	.0010	SAT
1355	.0020	.0010	.0000	.0002	.0003	.0030	SAT
1557	.0050	.0010	.0000	.0000	.0000	.0020	SAT
1858	.0020	.0000	.0000	.0000	.0000	.0004	SAT
2160	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2460	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2963	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2989	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3023	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3058	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3093	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3128	.0000	.0000	.0000	.0000	.0000	.0000	SAT

SUBURBAN INDUSTRIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-4AM	5-6AM	7-11AM	NOON-1PM	2-6PM	7PM-MID	DAY TYPE
0	.3630	.4440	.3240	.4240	.4450	.2990	SAT
50	.3540	.2960	.4320	.4190	.4170	.3910	SAT
152	.1150	.0990	.1300	.1030	.0900	.1450	SAT
250	.0660	.0640	.0410	.0280	.0250	.0600	SAT
352	.0390	.0220	.0200	.0130	.0120	.0300	SAT
452	.0210	.0370	.0190	.0030	.0060	.0200	SAT
553	.0130	.0170	.0160	.0020	.0030	.0190	SAT
653	.0090	.0050	.0040	.0000	.0000	.0060	SAT
752	.0030	.0020	.0020	.0000	.0010	.0090	SAT
853	.0020	.0020	.0010	.0000	.0000	.0060	SAT
954	.0020	.0000	.0040	.0080	.0020	.0050	SAT
1055	.0000	.0020	.0010	.0000	.0000	.0020	SAT
1151	.0030	.0030	.0040	.0000	.0000	.0020	SAT
1257	.0010	.0050	.0010	.0000	.0000	.0020	SAT
1355	.0030	.0030	.0000	.0000	.0000	.0020	SAT
1557	.0050	.0000	.0000	.0000	.0000	.0010	SAT
1858	.0010	.0000	.0000	.0000	.0000	.0000	SAT
2160	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2460	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2963	.0000	.0000	.0000	.0000	.0000	.0000	SAT
2989	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3023	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3058	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3093	.0000	.0000	.0000	.0000	.0000	.0000	SAT
3128	.0000	.0000	.0000	.0000	.0000	.0000	SAT

TABLE A-15. FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR SUNDAYS

URBAN RESIDENTIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-2AM	3-4AM	5-6AM	7-9AM	10AM-5PM	6PM-MID	DAY TYPE
0	.2820	.3650	.4300	.3660	.4010	.3010	SUN
50	.4870	.4570	.4370	.4910	.5210	.4680	SUN
152	.1220	.0880	.0730	.0870	.0580	.1350	SUN
250	.0490	.0400	.0270	.0310	.0160	.0510	SUN
352	.0240	.0210	.0140	.0100	.0030	.0220	SUN
452	.0120	.0100	.0090	.0090	.0002	.0110	SUN
553	.0080	.0080	.0040	.0030	.0002	.0050	SUN
653	.0060	.0050	.0040	.0020	.0002	.0030	SUN
752	.0040	.0010	.0010	.0003	.0000	.0010	SUN
853	.0050	.0020	.0020	.0000	.0001	.0010	SUN
954	.0010	.0020	.0010	.0000	.0000	.0004	SUN
1055	.0020	.0010	.0000	.0000	.0001	.0003	SUN
1151	.0000	.0000	.0000	.0000	.0000	.0003	SUN
1257	.0000	.0010	.0000	.0003	.0000	.0001	SUN
1355	.0010	.0000	.0000	.0000	.0000	.0000	SUN
1557	.0000	.0000	.0010	.0000	.0000	.0000	SUN
1858	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2160	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2460	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2963	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2989	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3023	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3058	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3093	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3128	.0000	.0000	.0000	.0000	.0000	.0000	SUN

URBAN COMMERCIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-2AM	3-7AM	8AM-NOON	1-5PM	6-10PM	11PM-MID	DAY TYPE
0	.1950	.3330	.2880	.2270	.1790	.2050	SUN
53	.3600	.4160	.4710	.4950	.4180	.3880	SUN
161	.1840	.1330	.1370	.1490	.2000	.1870	SUN
267	.0940	.0500	.0530	.0540	.0840	.0940	SUN
375	.0560	.0260	.0260	.0310	.0450	.0500	SUN
481	.0400	.0130	.0110	.0200	.0280	.0290	SUN
587	.0300	.0110	.0060	.0080	.0190	.0160	SUN
695	.0150	.0060	.0020	.0060	.0070	.0100	SUN
801	.0110	.0060	.0040	.0060	.0050	.0070	SUN
909	.0080	.0010	.0000	.0020	.0050	.0050	SUN
1015	.0030	.0010	.0010	.0020	.0030	.0040	SUN
1123	.0010	.0004	.0002	.0010	.0020	.0030	SUN
1229	.0010	.0004	.0000	.0000	.0010	.0020	SUN
1336	.0010	.0010	.0000	.0000	.0010	.0010	SUN
1443	.0010	.0004	.0000	.0000	.0002	.0010	SUN
1657	.0010	.0010	.0000	.0000	.0010	.0000	SUN
1977	.0000	.0010	.0000	.0000	.0000	.0000	SUN
2298	.0010	.0000	.0000	.0000	.0000	.0000	SUN
2619	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3153	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3197	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3232	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3267	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3301	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3336	.0000	.0000	.0000	.0000	.0000	.0000	SUN

TABLE A-15 (CONT'D). FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR SUNDAYS

URBAN INDUSTRIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-3AM	4-8AM	9-NOON	1-6PM	7-8PM	9PM-MID	DAY TYPE
0	.3290	.4330	.3660	.3520	.3050	.3240	SUN
53	.4290	.3530	.4680	.5320	.4900	.4330	SUN
161	.1220	.1230	.1160	.0960	.1350	.1430	SUN
267	.0560	.0450	.0270	.0110	.0400	.0420	SUN
375	.0150	.0160	.0070	.0060	.0140	.0250	SUN
481	.0190	.0110	.0090	.0020	.0090	.0120	SUN
587	.0170	.0110	.0040	.0010	.0030	.0120	SUN
695	.0050	.0060	.0020	.0010	.0000	.0080	SUN
801	.0050	.0030	.0010	.0010	.0030	.0020	SUN
909	.0010	.0010	.0010	.0000	.0000	.0010	SUN
1015	.0020	.0000	.0010	.0000	.0000	.0000	SUN
1123	.0000	.0000	.0000	.0000	.0000	.0000	SUN
1229	.0000	.0000	.0000	.0000	.0000	.0000	SUN
1336	.0010	.0000	.0000	.0000	.0000	.0000	SUN
1443	.0000	.0000	.0000	.0000	.0000	.0000	SUN
1657	.0000	.0000	.0000	.0000	.0000	.0000	SUN
1977	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2298	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2619	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3153	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3197	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3232	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3267	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3301	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3336	.0000	.0000	.0000	.0000	.0000	.0000	SUN

SUBURBAN RESIDENTIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-2AM	3-4AM	5-9AM	10AM-5PM	6PM	7PM-MID	DAY TYPE
0	.3800	.4500	.4790	.5170	.4580	.3600	SUN
50	.3900	.3570	.3810	.4040	.4210	.4070	SUN
152	.1110	.0970	.0770	.0600	.0770	.1180	SUN
250	.0450	.0340	.0300	.0130	.0300	.0530	SUN
352	.0280	.0240	.0150	.0030	.0080	.0240	SUN
452	.0210	.0160	.0090	.0020	.0040	.0160	SUN
553	.0110	.0090	.0060	.0004	.0000	.0100	SUN
653	.0050	.0040	.0030	.0000	.0000	.0040	SUN
752	.0030	.0040	.0010	.0000	.0000	.0040	SUN
853	.0030	.0030	.0002	.0001	.0000	.0010	SUN
954	.0020	.0020	.0002	.0000	.0000	.0020	SUN
1055	.0010	.0010	.0000	.0000	.0010	.0010	SUN
1151	.0010	.0000	.0000	.0000	.0000	.0000	SUN
1257	.0010	.0010	.0000	.0000	.0000	.0002	SUN
1355	.0000	.0000	.0000	.0000	.0000	.0000	SUN
1557	.0000	.0000	.0000	.0000	.0000	.0000	SUN
1858	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2160	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2460	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2963	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2989	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3023	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3058	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3093	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3128	.0000	.0000	.0000	.0000	.0000	.0000	SUN

TABLE A-15 (CONT'D). FREQUENCY DISTRIBUTION OF AMBIENT CO CONCENTRATIONS IN SIX NEIGHBORHOODS FOR SUNDAYS

SUBURBAN COMMERCIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-4AM	5-6AM	7AM	8AM-NOON	1-5PM	6PM-MID	DAY TYPE
0	.3240	.4420	.3860	.3540	.3410	.2740	SUN
50	.3640	.3780	.4150	.4440	.4480	.3760	SUN
152	.1480	.0880	.1110	.1380	.1430	.1770	SUN
250	.0630	.0400	.0400	.0360	.0370	.0790	SUN
352	.0310	.0160	.0120	.0140	.0190	.0360	SUN
452	.0180	.0130	.0170	.0070	.0060	.0200	SUN
553	.0150	.0070	.0090	.0030	.0020	.0120	SUN
653	.0100	.0040	.0010	.0020	.0010	.0080	SUN
752	.0050	.0050	.0020	.0010	.0010	.0050	SUN
853	.0070	.0020	.0040	.0010	.0002	.0040	SUN
954	.0050	.0010	.0020	.0005	.0000	.0030	SUN
1055	.0050	.0020	.0000	.0000	.0005	.0020	SUN
1151	.0020	.0010	.0000	.0000	.0000	.0010	SUN
1257	.0010	.0010	.0000	.0000	.0000	.0020	SUN
1355	.0010	.0000	.0000	.0000	.0000	.0010	SUN
1557	.0020	.0000	.0000	.0000	.0000	.0003	SUN
1858	.0003	.0000	.0000	.0000	.0000	.0003	SUN
2160	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2460	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2963	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2989	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3023	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3058	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3093	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3128	.0000	.0000	.0000	.0000	.0000	.0000	SUN

SUBURBAN INDUSTRIAL

CONC. INTERVAL LOWER BOUND MICROGRAM/CU.M.	1-2AM	3-7AM	8AM-NOON	1-5PM	6-7PM	8PM-MID	DAY TYPE
0	.3440	.4120	.4310	.5210	.4400	.3460	SUN
50	.3840	.3440	.4080	.3900	.3880	.4070	SUN
152	.1070	.0860	.0880	.0620	.1000	.1330	SUN
250	.0550	.0540	.0260	.0150	.0400	.0490	SUN
352	.0310	.0360	.0210	.0030	.0130	.0180	SUN
452	.0160	.0250	.0070	.0050	.0070	.0070	SUN
553	.0090	.0120	.0070	.0030	.0050	.0090	SUN
653	.0220	.0100	.0030	.0000	.0030	.0090	SUN
752	.0150	.0060	.0040	.0000	.0020	.0050	SUN
853	.0000	.0030	.0020	.0000	.0000	.0070	SUN
954	.0070	.0030	.0010	.0000	.0020	.0040	SUN
1055	.0050	.0030	.0010	.0000	.0000	.0010	SUN
1151	.0040	.0030	.0000	.0010	.0000	.0030	SUN
1257	.0000	.0010	.0000	.0010	.0000	.0010	SUN
1355	.0000	.0020	.0000	.0000	.0000	.0010	SUN
1557	.0020	.0000	.0000	.0000	.0000	.0000	SUN
1858	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2160	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2460	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2963	.0000	.0000	.0000	.0000	.0000	.0000	SUN
2989	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3023	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3058	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3093	.0000	.0000	.0000	.0000	.0000	.0000	SUN
3128	.0000	.0000	.0000	.0000	.0000	.0000	SUN

APPENDIX B

SUPPORTING MATERIAL FOR CO CONCENTRATIONS FROM MOBILE SOURCE MICROENVIRONMENTS

DEVELOPMENT OF LOGNORMAL POLLUTANT DISTRIBUTIONS FOR PARKING GARAGES AND ROADWAY TUNNELS

The lognormal distribution has historically been used to describe ambient air concentration distributions. For areas where the pollutant concentration distribution is not completely defined by measured values, but values such as the mean, median, mode or range are known, the properties of the lognormal distribution can be used to define the complete pollutant distribution.

The lognormal distribution is defined as:$^{(1)}$

$$df\ (x) = \left(\frac{1}{X\sigma\sqrt{2\pi}}\right) \exp\left[-\frac{1}{2\ \sigma^2}\left(\ln X - \mu\right)^2\right] dx$$

Obviously, if σ and μ are known, the distribution can be defined for any value of X.

Additionally for a lognormal distribution:$^{(1)}$

$$\text{Mean, } \overline{X} = e\ (\mu + 1/2\ \sigma^2)$$

$$\text{Median} = e^{\mu}$$

$$\text{Mode} = e^{\mu-\sigma}$$

The coefficient of variation n, defined as the standard deviation divided by the mean is:

$$n = \frac{S}{\overline{X}} = \sqrt{e^{\sigma^2} - 1}$$

For the parking garage, the concentration distributions were developed by using a CO concentration value known to be typical of parking garages as the distribution mode, then adjusting the median so that the frequency of occurence in the 300 to 400 ppm CO range was 0.01 percent. If the median and mode are known, then μ and σ are solved for as follows:

$$\ln\ (\text{median}) = \ln\ (e^{\mu})$$

$$\mu = \ln\ (\text{median})$$

$$\ln\ (\text{mode}) = \ln\ (e^{\mu-\sigma^2})$$

$$\mu - \sigma^2 = \ln\ (\text{mode})$$

$$\sigma = \sqrt{\ln\ (\text{mode}) - \mu}$$

With μ and σ defined, the entire lognormal distirbution can be defined.

For roadway tunnels a slightly different approach was used. The measured data on concentrations in roadway tunnels produced a mean value and a maximum value of CO concentration as a function of average daily traffic (ADT).

Using the proper CO emission factor, these CO levels were converted to pollutant concentrations for a 1.0 g/minute emission factor (see text). The CO concentrations and pollutant concentrations at 1.0 g/minute for several ADT values are shown in the table below.

ADT	Mean	Max.	Pollutant Concentration, $\mu g/m^3$ at 1.0 g/min(a) Mean	Pollutant Concentration, $\mu g/m^3$ at 1.0 g/min(a) Max.
0.5	5.2	66.7	166.2	2131.8
1.5	14.3	94.4	457.0	3017.2
2.5	23.4	122.1	747.9	3902.5
3.5	32.5	149.8	1038.7	4787.8
4.5	41.6	177.4	1329.6	5669.9
5.5	50.7	205.1	1620.4	6555.3
6.5	59.9	232.8	1914.5	7440.6

(a) based on a CO emission factor of 62.06 g/mile at 35 mph

Assuming that the pollutant concentration is lognormally distributed, the problem is to define the distribution for each value of ADT, given only the mean and maximum concentrations. Note that if the minimum concentration is assumed to be 0 then the range (maximum - minimum) is also known. The expression for the mean of a lognormal distribution is shown above. It can also be shown that the standard deviation, S, can be approximated by the following relationship, assuming that the range available is the result of a large number of observations(2)

$$S = \frac{\text{range}}{6.5}$$

Thus the standard deviation for the tunnel distribution can be estimated from the range. If the standard deviation and mean are known the coefficient of variation is known and σ can be obtained as follows:

$$n = \left(\frac{\frac{\text{range}}{6.5}}{\bar{X}} \right) = \sqrt{e^{\sigma^2} - 1}$$

$$n^2 = e^{\sigma^2} - 1$$

$$e^{\sigma^2} = n^2 + 1$$

$$\sigma^2 = \ln\ (n^2 + 1)$$

$$\sigma = \sqrt{\ln\ (n^2 + 1)}$$

Once σ is known, μ can be obtained from the equation for the mean:

$$\bar{X} = e^{(\mu + 1/2\ \sigma^2)}$$

$$\mu + 1/2\ \sigma^2 = \ln \bar{X}$$

$$\mu = \ln \bar{X} - 1/2\ \sigma^2$$

With both μ and σ known the distribution is fully defined. The table below shows the μ and σ for the tunnel pollutant concentration distributions at seven different values of ADT.

ADT	range (max-min)	std. dev. $S = \frac{\text{range}}{6.5}$	mean $= \bar{X}$	$n = \frac{S}{\bar{X}}$	σ	μ
0.5	2131.8	327.97	166.2	1.97	1.26	4.32
1.5	2017.2	464.18	457.0	1.02	0.84	5.77
2.5	3902.5	600.38	747.0	0.80	0.71	6.37
3.5	4787.8	736.58	1038.7	0.71	0.64	6.74
4.5	5660.0	872.29	1329.6	0.66	0.60	7.01
5.5	6555.3	1008.51	1620.4	0.62	0.57	7.23
6.5	7440.6	1144.71	1914.5	0.60	0.55	7.40

References:

1. Aitchison, J. and Brown, J.A.C., The Lognormal Distribution, Cambridge University Press, New York, 1957.

2. Sokal, R. and Rohof, T.J., Biometry, W. H. Freeman and Co., 1981,

LISTING OF EDITING PROGRAM FOR SAROAD DATA TAPES

```
      PROGRAM EDTEPA(INPUT,OUTPUT,EDDAT,TAPE2=EDDAT,TAPE60=INPUT)
      DIMENSION  IMON(2),IDAY(2),ILINE(2),ITYPE(2), RDG(12,2),IUNT(2)
      DIMENSION  NAR1(2),NAR2(2),NAR3(2),NAR4(2),ISTA(2),DUM(12),IDEC(2)
      ISTA(2) =   1960085
      I=1
      J=1
      K=1
   50 READ 1000,NAR1(K),ISTA(K),NAR2(K),NAR3(K),IMON(K),IDAY(K),
     1ILINE(K), NAR4(K),ITYPE(K),IUNT(K),IDEC(K),(RDG(M,K),M=1,12)
      IF(EOF(60))999,55
   55 CONTINUE
      IF(IDEC(K).NE.1) GO TO 57
      DO 56 L=1,12
   56 RDG(L,K)= RDG(L,K)/10.
   57 IF(IUNT(K).NE.05) GO TO 59
      DO 58 L=1,12
   58 RDG(L,K)= RDG(L,K)/1.15
   59 IF(ISTA(2).EQ.ISTA(1)) GO TO 60
      IF(K.EQ.2) GO TO 220
      I=1
      J=1
      K=1
   60 CONTINUE
      IF(K.NE.1) GO TO 100
      IF(IMON(1).NE.I) GO TO 150
   65 IF(IDAY(1).NE.J) GO TO 170
   70 IF(ILINE(1).NE.0)GO TO 180
      CALL DAYWEK(IMON(K),IDAY(K),ITYPE(K))
   75 WRITE(2,3000) NAR1(K),ISTA(K),NAR2(K),NAR3(K),IMON(K),IDAY(K),
     1     ILINE(K),NAR4(K),ITYPE(K),IUNT(K),IDEC(K),(RDG(M,K),M=1,12)
      IF(ILINE(K).EQ.0)K=2
      GO TO 50
  100 IF(IMON(2).NE.IMON(1).OR.IDAY(2).NE.IDAY(1)) GO TO 220
      IF(ILINE(2).EQ.1) GO TO 110
      PRINT 2000 , ISTA(K),IMON(K),IDAY(K)
  110 CALL DAYWEK(IMON(K),IDAY(K),ITYPE(K))
      WRITE(2,3000) NAR1(K),ISTA(K),NAR2(K),NAR3(K),IMON(K),IDAY(K),
     1     ILINE(K),NAR4(K),ITYPE(K),IUNT(K),IDEC(K),(RDG(M,K),M=1,12)
      J= J+1
      IF(J.LT.32) GO TO 120
      I=I+1
      J=1
  120 K=1
      GO TO 50
  150 PRINT 2010, ISTA(K), I, IMON(K)
      I=IMON(K)
      J=1
      GO TO 65
  170 PRINT 2020, ISTA(K),I,J,IDAY(K)
      J=IDAY(K)
      GO TO 70
C**** IF THERE IS NO FIRST LINE OF DATA
  180 PRINT 2030, ISTA(K),IMON(K),IDAY(K)
      IF(ILINE(K).NE.1) GO TO 190
      CALL DUMREC( DUM,IDUML,IDUM4,K)
      CALL DAYWEK(IMON(K),IDAY(K),ITYPE(K))
      WRITE(2,3000)  NAR1(K),ISTA(K),NAR2(K),NAR3(K),IMON(K),IDAY(K),
     1              IDUML,IDUM4,ITYPE(K),IUNT(K),IDEC(K),(DUM(M),M=1,12)
      J=J+1
      GO TO 75
  190 PRINT 2040, ISTA(K),IMON(K),IDAY(K)
  200 GO TO 75
  220 PRINT 2050, ISTA(1),IMON(1),IDAY(1),IMON(2),IDAY(2),ISTA(2)
      CALL DUMREC( DUM,IDUML,IDUM4,K)
      K=1
      WRITE(2,3000)  NAR1(K),ISTA(K),NAR2(K),NAR3(K),IMON(K),IDAY(K),
     1              IDUML,IDUM4,ITYPE(K),IUNT(K),IDEC(K),(DUM(M),M=1,12)
      NAR1(1)=NAR1(2)
      NAR2(1)=NAR2(2)
      NAR3(1)=NAR3(2)
      NAR4(1)=NAR4(2)
      IMON(1)=IMON(2)
       IDAY(1)=IDAY(2)
      ITYPE(1)=ITYPE(2)
      ISTA(1)=ISTA(2)
      IUNT(1)=IUNT(2)
      IDEC(1)=IDEC(2)
      ILINE(1)=ILINE(2)
      DO 225 M=1,12
  225 RDG(M,1)=RDG(M,2)
      I=IMON(K)
      J=IDAY(K)
      GO TO 70
 1000 FORMAT(I3,I7,A3,I3,I2,I2,I1,I6,I2,I2,I1,12F4.0)
 2000 FORMAT(1X,FOR STATION ",I7," SOMETHING IS WRONG AT ",I2,"/",I2,
     1       "LINE 2")
 2010 FORMAT(1X,FOR STATION ",I7," DATA IS MISSING FOR MONTH ",I2,
     1       ". NEXT MONTH WITH DATA IS MONTH ",I2)
 2020 FORMAT(1X,FOR STATION ",I7," DATA IS MISSING FOR MONTH ",I2,
     1       " DAY ",I2,".  NEXT DAY WITH DATA IS DAY " I2)
 2030 FORMAT(1X,FOR STATION ",I7," THERE IS NO FIRST LINE OF DATA FOR "
     1       ,I2,"/",I2)
 2040 FORMAT(1X,FOR STATION ",I7," SOMETHING IS WRONG AT ",I2,"/",I2,
     1       "LINE 1")
 2050 FORMAT(1X,FOR STATION ",I7," THERE IS NO SECOND LINE OF DATA FOR"
     1       1X,I2,"/"I2,".  NEXT DATA IS ",I2,"/",I2," STATION ",I7)
 3000 FORMAT(I3,I7,A3,I3,I2,I2,I1,I6,I2,I2,I1,12F4.1)
  999 STOP
      END
      SUBROUTINE DAYWEK(IMON,IDAY,ITYPE)
      COMMON/SATDA /ISAT(52)/SUNDA /ISUN(52)
      IDATE =(IMON   *100) + IDAY
      ITYPE   = 1
      DO 100 L = 1,52
      IF(IDATE.EQ.ISAT(L)) ITYPE   = 2
      IF(IDATE.EQ.ISUN(L)) ITYPE   = 3
  100 CONTINUE
      RETURN
      END
      SUBROUTINE DUMREC( DUM,IDUML,IDUM4,K)
      DIMENSION  DUM(12)
      DO 200 I= 1,12
       DUM(I) = 99.9
  200 CONTINUE
      IF(K.EQ.1) IDUML = 0
      IF(K.EQ.1) IDUM4 = 042101
      IF(K.EQ.2) IDUML = 1
      IF(K.EQ.2) IDUM4 = 242101
      RETURN
      END
      BLOCK DATA  SATDATE
      COMMON/SATDA/ISAT(52)
      DATA (ISAT(I),I=1,52)/
     1        0103,0110,0117,0124,0131,0207,0214,
     2        0221,0228,0307,0314,0321,0328,0404,
     3        0411,0418,0425,0502,0509,0516,0523,
     4        0530,0606,0613,0620,0627,0704,0711,
     5        0718,0725,0801,0808,0815,0822,0829,
     6        0905,0912,0919,0926,1003,1010,1017,
     7        1024,1031,1107,1114,1121,1128,1205,
     8        1212,1219,1226/
      END
      BLOCK DATA SUNDATE
      COMMON/SUNDA/ISUN(52)
      DATA (ISUN(I),I=1,52)/
     1        0104,0111,0118,0125,0201,0208,0215,
     2        0222,0301,0308,0315,0322,0329,0405,
     3        0412,0419,0426,0503,0510,0517,0524,
     4        0531,0607,0614,0621,0628,0705,0712,
     5        0719,0726,0802,0809,0816,0823,0830,
     6        0906,0913,0920,0927,1004,1011,1018,
     7        1025,1101,1108,1115,1122,1129,1206,
     8        1213,1220,1227/
      END
```

APPENDIX C

SUPPORTING MATERIAL FOR NATIONAL POPULATION BY NEIGHBORHOOD TYPE

TABLE C-1. ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUPS FOR WEEKDAYS

HOUR OF DAY																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	AO	DAY
82	82	82	82	82	82	82	82	81	81	85	81	82	81	81	81	85	82	82	82	82	82	82	82	11	WKD
82	82	82	82	82	82	82	82	82	81	81	81	82	85	81	81	81	85	84	82	81	82	82	82	12	WKD
82	82	82	82	82	82	82	83	91	91	91	91	92	91	95	91	93	82	84	82	82	82	82	82	13	WKD
82	82	82	82	82	82	82	82	83	91	91	91	92	95	95	91	91	91	93	82	82	82	82	81	14	WKD
82	82	82	82	82	82	82	82	91	91	91	91	92	91	91	91	91	82	82	82	82	82	82	82	21	WKD
82	82	82	82	82	82	82	82	91	91	91	91	91	91	91	91	91	82	82	82	82	82	82	82	22	WKD
82	82	82	82	82	82	82	83	91	91	91	91	92	91	91	91	91	83	82	82	82	82	82	82	23	WKD
82	82	82	82	82	82	82	83	91	91	91	91	91	91	91	91	91	93	82	82	82	82	82	82	24	WKD
82	82	82	82	82	82	82	82	91	91	91	91	92	91	91	91	91	82	82	82	82	82	82	82	31	WKD
82	82	82	82	82	82	82	83	91	91	91	91	92	91	91	91	91	93	82	82	82	82	82	82	32	WKD
82	82	82	82	82	82	82	82	94	94	95	94	92	94	94	95	94	82	82	82	82	82	82	82	33	WKD
82	82	82	82	82	82	82	82	82	91	93	95	92	93	95	91	91	82	82	82	82	82	82	82	34	WKD
82	82	82	82	82	82	82	82	83	91	93	91	92	93	91	91	91	93	82	82	82	82	82	82	35	WKD
82	82	82	82	82	82	82	82	91	91	91	91	91	91	91	91	91	82	82	82	82	82	82	82	41	WKD
82	82	82	82	82	82	82	83	91	91	91	91	92	91	91	91	91	93	82	82	82	82	82	82	42	WKD
91	91	82	82	82	82	82	82	82	82	82	82	82	82	82	82	92	91	91	91	91	91	91	91	43	WKD
91	91	93	82	82	82	82	82	82	82	82	82	82	84	82	82	83	91	91	91	91	91	91	91	44	WKD
82	82	82	82	82	82	82	81	83	94	94	94	92	93	94	94	91	82	82	82	82	82	82	82	45	WKD
82	82	82	82	82	82	82	82	91	93	94	91	92	93	94	91	91	82	82	82	82	82	82	82	46	WKD
82	82	82	82	82	82	82	91	91	91	91	91	91	91	91	91	82	82	82	84	82	82	82	82	51	WKD
82	82	82	82	82	82	83	91	91	91	91	91	91	91	91	91	93	82	82	82	82	82	82	82	52	WKD
91	82	82	82	82	82	82	82	82	82	82	82	82	83	82	82	91	91	91	91	91	91	91	91	53	WKD
91	91	91	91	91	91	91	82	82	82	82	82	82	82	82	83	82	82	82	82	82	82	82	91	54	WKD
82	82	82	82	82	82	82	82	95	95	94	95	92	91	95	95	95	82	82	82	82	82	82	82	55	WKD
82	82	82	82	82	82	82	82	91	91	95	91	91	95	95	91	91	82	82	82	82	82	82	82	56	WKD
82	82	82	82	82	82	82	91	91	91	91	91	91	91	91	91	82	82	82	82	82	82	82	82	61	WKD
82	82	82	82	82	82	83	91	91	91	91	91	91	91	91	91	93	84	82	82	82	82	82	82	62	WKD
91	82	82	82	82	82	82	82	82	82	82	82	82	82	83	82	91	91	91	91	91	91	91	91	63	WKD
91	91	91	91	91	91	91	82	82	82	82	82	82	82	83	82	82	82	82	82	82	82	82	91	64	WKD
82	82	82	82	82	82	82	82	91	95	94	95	92	95	91	95	95	82	82	82	82	82	82	82	65	WKD
82	82	82	82	82	82	93	93	93	93	94	92	93	93	92	93	93	82	82	82	82	82	82	82	66	WKD

EXPLANATION OF CODE:

1. SEE TEST TABLE IV-3 FOR EXPLANATION OF AO GROUP CODES

2. FIRST DIGIT OF TWO DIGIT ACTIVITY CODE IS EITHER 8 OR 9.
   8 = HOME NEIGHBORHOOD
   9 = WORK NEIGHBORHOOD

3. SECOND DIGIT OF TWO DIGIT ACTIVITY CODE IS MICROENVIRONMENT AS FOLLOWS:
   1 = INDOORS AT WORK
   2 = INDOORS, OTHER
   3 = VEHICLE
   4 = ROADSIDE
   5 = OUTDOORS

4. EXAMPLE: ACTIVITY CODE 94 IS WORK NEIGHBORHOOD, ROADSIDE MICROENVIRONMENT

TABLE C-1 (CONT'D). ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUPS FOR WEEKDAYS

HOUR OF DAY																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	AO	DAY
82	82	82	82	82	82	82	82	91	91	91	91	92	91	91	91	91	82	82	82	82	82	82	82	81	WKD
82	82	82	82	82	82	82	83	91	91	91	91	92	91	91	91	91	93	82	82	82	82	82	82	82	WKD
91	82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	91	91	91	91	91	91	91	91	83	WKD
82	82	82	82	82	82	82	82	82	91	93	94	92	94	93	93	93	91	82	82	82	82	82	82	84	WKD
82	82	82	82	82	82	82	82	81	81	85	81	81	81	83	85	81	82	82	82	82	82	82	82	85	WKD
82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	83	82	82	82	82	82	82	86	WKD
82	82	82	82	82	82	82	82	82	82	82	85	82	82	83	82	82	82	82	82	82	82	82	82	91	WKD
82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	83	82	82	82	82	82	82	82	92	WKD
82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	83	82	82	82	82	82	82	82	82	93	WKD
82	82	82	82	82	82	82	82	82	83	91	92	94	91	93	85	82	82	82	82	82	82	82	82	101	WKD
82	82	82	82	82	82	82	82	82	84	83	82	82	84	85	82	82	82	82	84	82	82	82	82	102	WKD
82	82	82	82	82	82	82	82	82	82	85	82	82	82	84	82	82	82	82	82	82	82	82	82	103	WKD
82	82	82	82	82	82	82	82	82	82	82	82	82	85	84	82	82	82	82	82	82	82	82	82	104	WKD
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	82	82	105	WKD
82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	82	82	82	106	WKD
82	82	82	82	82	82	82	82	82	82	83	82	82	82	85	82	82	82	82	82	82	82	82	82	111	WKD
82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	82	82	82	82	82	82	82	82	112	WKD
82	82	82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	82	82	82	82	82	82	82	113	WKD
82	82	82	82	82	82	82	82	83	82	82	85	82	82	82	85	82	82	82	82	82	82	82	82	114	WKD
82	82	82	82	82	82	82	82	81	81	85	81	81	81	81	82	85	82	82	82	82	82	82	82	121	WKD
82	82	82	82	82	82	82	84	81	81	81	85	81	81	81	84	82	85	82	82	82	82	82	82	122	WKD
82	82	82	82	82	82	82	82	83	81	81	81	81	85	81	83	82	85	82	82	82	82	82	82	123	WKD
82	82	82	82	82	82	82	82	81	81	81	85	81	81	81	81	85	82	82	82	82	82	82	82	124	WKD
82	82	82	82	82	82	82	84	81	81	81	81	85	81	81	81	84	82	82	82	82	82	82	82	125	WKD
82	82	82	82	82	82	82	83	81	85	81	81	81	81	81	83	82	85	82	82	82	82	82	82	126	WKD

EXPLANATION OF CODE:

1. SEE TEST TARLE IV-3 FOR EXPLANATION OF AO GROUP CODES

2. FIRST DIGIT OF TWO DIGIT ACTIVITY CODE IS EITHER 8 OR 9.
   8 = HOME NEIGHBORHOOD
   9 = WORK NEIGHBORHOOD

3. SECOND DIGIT OF TWO DIGIT ACTIVITY CODE IS MICROENVIRONMENT AS FOLLOWS:
   1 = INDOORS AT WORK
   2 = INDOORS, OTHER
   3 = VEHICLE
   4 = ROADSIDE
   5 = OUTDOORS

4. EXAMPLE: ACTIVITY CODE 94 IS WORK NEIGHBORHOOD, ROADSIDE MICROENVIRONMENT

TABLE C-2. ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUPS FOR SATURDAYS

HOUR OF DAY 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	AO	DAY
82	82	82	82	82	82	82	82	82	82	85	83	82	82	85	82	82	82	82	83	82	82	82	82	11	SAT
82	82	82	82	82	82	82	82	82	82	82	85	83	82	82	82	82	82	82	82	82	82	82	82	12	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	82	82	82	82	13	SAT
82	82	82	82	82	82	82	82	82	82	82	83	82	82	85	85	82	82	82	82	82	82	82	82	14	SAT
82	82	82	82	82	82	82	82	82	82	85	82	82	82	83	82	82	82	82	82	82	82	82	82	21	SAT
82	82	82	82	82	82	82	82	82	82	84	82	83	82	82	85	82	82	82	82	82	82	82	82	22	SAT
82	82	82	82	82	82	82	82	82	85	82	82	82	83	82	82	82	82	82	82	82	82	82	82	23	SAT
82	82	82	82	82	82	82	82	82	82	85	82	82	82	83	82	84	82	82	82	82	82	82	82	24	SAT
82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	83	82	82	82	82	31	SAT
82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	82	82	82	82	83	82	82	82	82	32	SAT
82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	82	82	82	82	82	82	82	82	82	33	SAT
82	82	82	82	82	82	82	82	91	93	95	91	92	95	93	91	82	82	85	82	82	82	82	82	34	SAT
82	82	82	82	82	82	82	82	82	82	85	82	82	82	83	82	82	82	82	82	82	82	82	82	35	SAT
82	82	82	82	82	82	82	82	82	83	84	82	82	82	82	85	82	82	82	82	82	82	82	82	41	SAT
82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	82	82	83	82	82	82	42	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	83	84	82	82	82	82	82	82	43	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	83	84	82	82	82	82	82	82	82	82	82	44	SAT
82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	83	84	82	82	82	82	45	SAT
82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	83	84	82	82	82	82	82	82	82	46	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	82	84	85	82	82	82	83	82	82	82	82	51	SAT
82	82	82	82	82	82	82	82	82	83	84	82	82	82	82	85	82	82	82	82	82	82	82	82	52	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	83	84	82	82	82	82	82	53	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	83	82	82	82	82	54	SAT
82	82	82	82	82	82	82	82	82	82	84	82	82	82	85	82	82	82	82	83	82	82	82	82	55	SAT
82	82	82	82	82	82	82	82	82	83	84	82	82	82	85	82	82	82	82	82	82	82	82	82	56	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	82	83	84	82	82	82	82	82	82	82	82	61	SAT
82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	82	82	82	82	82	82	82	82	82	62	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	83	84	82	82	82	82	82	82	63	SAT
82	82	82	82	82	82	82	82	82	83	94	82	82	85	83	82	82	82	82	82	82	82	82	82	64	SAT
82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	82	85	84	82	82	82	82	82	82	65	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	84	82	82	82	82	66	SAT

EXPLANATION OF CODE:

1. SEE TEST TABLE IV-3 FOR EXPLANATION OF AO GROUP CODES

2. FIRST DIGIT OF TWO DIGIT ACTIVITY CODE IS EITHER 8 OR 9.
8 = HOME NEIGHBORHOOD
9 = WORK NEIGHBORHOOD

3. SECOND DIGIT OF TWO DIGIT ACTIVITY CODE IS MICROENVIRONMENT AS FOLLOWS:
1 = INDOORS AT WORK
2 = INDOORS, OTHER
3 = VEHICLE
4 = ROADSIDE
5 = OUTDOORS

4. EXAMPLE: ACTIVITY CODE 94 IS WORK NEIGHBORHOOD, ROADSIDE MICROENVIRONMENT

TABLE C-2 (CONT'D). ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUPS FOR SATURDAYS

HOUR OF DAY 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	AO	DAY
82	82	82	82	82	82	82	82	82	85	85	82	82	82	83	82	82	82	82	82	82	82	82	82	81	SAT
82	82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	82	82	82	82	83	82	82	82	82	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	83	84	82	82	82	82	82	82	82	82	82	83	SAT
82	82	82	82	82	82	82	82	82	81	83	84	82	83	84	83	83	81	82	82	82	82	82	82	84	SAT
82	82	82	82	82	82	82	82	82	83	82	82	82	84	82	85	82	82	82	82	82	82	82	82	85	SAT
82	82	82	82	82	82	82	82	82	82	84	82	82	82	82	83	82	82	82	82	82	82	82	82	86	SAT
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	84	83	82	82	82	91	SAT
82	82	82	82	82	82	82	82	82	85	82	82	82	83	84	82	82	82	82	82	82	82	82	82	92	SAT
82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	82	82	82	82	82	82	83	82	93	SAT
82	82	82	82	82	82	82	82	82	84	82	82	82	82	83	82	82	82	82	82	82	82	82	82	101	SAT
82	82	82	82	82	82	82	82	82	82	84	82	82	82	85	84	82	82	82	83	84	82	82	82	102	SAT
82	82	82	82	82	82	82	82	82	82	83	82	82	82	84	85	82	82	82	82	82	82	82	82	103	SAT
82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	84	82	82	82	82	82	82	82	82	104	SAT
82	82	82	82	82	82	82	82	82	82	82	83	82	82	82	85	82	82	82	82	82	82	82	82	105	SAT
82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	82	82	82	82	82	106	SAT
82	82	82	82	82	82	82	82	82	82	85	82	82	83	82	85	82	82	82	82	82	82	82	82	111	SAT
82	82	82	82	82	82	82	82	82	85	82	82	82	82	83	82	82	82	82	82	82	82	82	82	112	SAT
82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	83	85	82	82	82	82	82	82	82	113	SAT
82	82	82	82	82	82	82	82	82	85	82	82	82	85	82	82	83	82	82	82	82	82	82	82	114	SAT
82	82	82	82	82	82	82	82	82	82	83	82	82	82	85	85	82	82	82	82	82	82	82	82	121	SAT
82	82	82	82	82	82	82	82	82	82	85	85	82	82	84	82	82	82	82	83	82	82	82	82	122	SAT
82	82	82	82	82	82	82	82	82	82	84	82	82	82	84	85	82	82	82	82	82	82	82	82	123	SAT
82	82	82	82	82	82	82	82	82	82	82	85	82	84	85	82	82	82	82	83	82	82	82	82	124	SAT
82	82	82	82	82	82	82	82	82	85	82	82	82	82	84	82	85	82	82	83	82	82	82	82	125	SAT
82	82	82	82	82	82	82	82	82	82	84	82	82	85	85	82	82	82	82	82	82	83	82	82	126	SAT

EXPLANATION OF CODE:

1. SEE TEST TABLE IV-3 FOR EXPLANATION OF AO GROUP CODES

2. FIRST DIGIT OF TWO DIGIT ACTIVITY CODE IS EITHER 8 OR 9.
   8 = HOME NEIGHBORHOOD
   9 = WORK NEIGHBORHOOD

3. SECOND DIGIT OF TWO DIGIT ACTIVITY CODE IS MICROENVIRONMENT AS FOLLOWS:
   1 = INDOORS AT WORK 3 = VEHICLE 5 = OUTDOORS
   2 = INDOORS, OTHER 4 = ROADSIDE

4. EXAMPLE: ACTIVITY CODE 94 IS WORK NEIGHBORHOOD, ROADSIDE MICROENVIRONMENT

TABLE C-3. ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUPS FOR SUNDAYS

HOUR OF DAY																									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	AO	DAY
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	81	81	82	82	11	SUN
82	82	82	82	82	82	82	82	82	82	82	85	82	83	82	85	85	82	82	81	81	82	82	82	12	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	85	82	82	82	82	82	82	82	82	13	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	84	82	85	85	82	83	82	82	82	82	82	14	SUN
82	82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	82	82	82	82	82	82	82	82	21	SUN
82	82	82	82	82	82	82	82	82	82	83	82	82	82	82	84	82	82	82	82	82	82	82	82	22	SUN
82	82	82	82	82	82	82	82	82	82	82	82	83	82	82	85	82	82	82	82	82	82	82	82	23	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	84	82	82	83	82	82	82	82	82	82	82	24	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	83	85	82	82	82	82	82	82	82	82	82	31	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	82	82	32	SUN
82	82	82	82	82	82	82	82	82	82	82	84	82	82	82	84	82	82	82	82	82	82	82	82	33	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	93	95	91	82	82	82	82	82	82	82	34	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	82	82	82	82	35	SUN
82	82	82	82	82	82	82	82	82	82	82	83	82	82	85	82	82	82	82	82	82	82	82	82	41	SUN
82	82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	84	82	82	82	82	82	82	42	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	82	82	82	82	43	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	85	82	82	82	82	82	82	82	44	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	45	SUN
82	82	82	82	82	82	82	82	85	85	82	82	82	82	82	82	82	85	82	82	82	82	82	82	46	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	84	82	82	82	84	82	82	82	82	82	51	SUN
82	82	82	82	82	82	82	82	83	82	82	82	82	82	82	85	82	82	82	82	82	82	82	82	52	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	84	82	82	82	82	82	82	82	82	82	53	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	83	85	82	82	82	82	82	82	82	82	54	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	83	82	82	82	82	82	82	82	82	55	SUN
82	82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	84	82	82	83	82	82	82	82	56	SUN
82	82	82	82	82	82	82	82	82	82	83	82	82	85	85	82	82	82	82	82	82	82	82	82	61	SUN
82	82	82	82	82	82	82	82	83	82	82	82	82	82	82	85	82	82	82	82	82	82	82	82	62	SUN
82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	82	82	84	82	82	82	82	82	82	63	SUN
82	82	82	82	82	82	82	82	82	82	84	82	82	85	85	82	82	82	82	82	82	82	82	82	64	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	83	82	82	82	65	SUN
82	82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	82	82	82	82	82	82	82	66	SUN

EXPLANATION OF CODE:

1. SEE TEST TABLE IV-3 FOR EXPLANATION OF AO GROUP CODES

2. FIRST DIGIT OF TWO DIGIT ACTIVITY CODE IS EITHER 8 OR 9.
   8 = HOME NEIGHBORHOOD
   9 = WORK NEIGHBORHOOD

3. SECOND DIGIT OF TWO DIGIT ACTIVITY CODE IS MICROENVIRONMENT AS FOLLOWS:
   1 = INDOORS AT WORK   3 = VEHICLE   5 = OUTDOORS
   2 = INDOORS, OTHER   4 = ROADSIDE

4. EXAMPLE: ACTIVITY CODE 94 IS WORK NEIGHBORHOOD, ROADSIDE MICROENVIRONMENT

TABLE C-3 (CONT'D). ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUPS FOR SUNDAYS

										HOUR OF DAY															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	AO	DAY
82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	84	82	82	82	82	82	82	82	81	SUN
82	82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	82	82	82	82	82	82	82	82	82	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	85	82	82	82	82	83	82	82	82	83	SUN
82	82	82	82	82	82	82	82	82	82	82	83	82	82	85	82	82	82	82	82	82	82	82	82	84	SUN
82	82	82	82	82	82	82	82	82	82	82	85	82	83	85	85	82	82	82	83	82	82	82	82	85	SUN
82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	82	82	82	82	82	82	82	82	86	SUN
82	82	82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	82	82	82	82	82	82	82	91	SUN
82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	82	82	82	82	82	82	82	82	82	92	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	83	85	82	82	82	82	82	82	82	82	93	SUN
82	82	82	82	82	82	82	82	82	85	82	82	82	82	85	82	82	82	84	82	82	82	82	82	101	SUN
82	82	82	82	82	82	82	82	82	82	84	82	82	82	82	85	82	84	82	82	82	82	82	82	102	SUN
82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	84	82	82	82	82	82	82	82	82	103	SUN
82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	82	82	82	82	82	82	82	82	104	SUN
82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	82	82	82	82	82	82	82	82	82	105	SUN
82	82	82	85	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	106	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	82	82	82	82	82	82	82	111	SUN
82	85	82	83	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	112	SUN
82	82	82	82	82	82	82	82	82	82	82	82	82	85	82	82	83	82	82	82	82	82	82	82	113	SUN
82	82	82	82	82	82	82	82	82	83	82	82	82	85	82	82	83	82	82	82	82	82	82	82	114	SUN
82	82	82	82	82	82	82	82	82	83	82	82	82	82	82	85	85	82	82	82	82	82	82	82	121	SUN
82	82	82	82	82	82	82	82	82	82	82	83	82	82	85	82	85	82	82	82	82	82	82	82	122	SUN
82	82	82	82	82	82	82	82	82	82	85	84	82	82	82	85	82	82	82	82	82	82	82	82	123	SUN
82	82	82	82	82	82	82	83	82	82	82	82	82	82	85	85	82	82	82	82	82	82	82	82	124	SUN
82	82	82	82	82	82	82	82	82	82	82	83	82	82	85	85	82	82	82	82	82	82	82	82	125	SUN
82	82	82	82	82	82	82	82	82	83	82	82	82	82	85	82	85	82	82	82	82	82	82	82	126	SUN

EXPLANATION OF CODE:

1. SEE TEST TABLE IV-3 FOR EXPLANATION OF AO GROUP CODES

2. FIRST DIGIT OF TWO DIGIT ACTIVITY CODE IS EITHER 8 OR 9.
   8 = HOME NEIGHBORHOOD
   9 = WORK NEIGHBORHOOD

3. SECOND DIGIT OF TWO DIGIT ACTIVITY CODE IS MICROENVIRONMENT AS FOLLOWS:
   1 = INDOORS AT WORK
   2 = INDOORS, OTHER
   3 = VEHICLE
   4 = ROADSIDE
   5 = OUTDOORS

4. EXAMPLE: ACTIVITY CODE 94 IS WORK NEIGHBORHOOD, ROADSIDE MICROENVIRONMENT

TABLE C-4. COHORT POPULATIONS BY STUDY AREA

Cohort description				Cohort population			
A-O group	Home NT[a]	Work NT[a]	Subgroup	Chicago	Philadelphia	St. Louis	Los Angeles
Students 18+ 01	CR 1	CR 1	1	19,316	4,239	3,753	17,261
			2	37,792	8,293	7,344	33,771
			3	9,238	2,027	1,794	8,255
			4	17,636	3,870	3,427	15,760
	SR 5	SR 5	1	5,897	17,387	5,334	61,326
			2	11,538	34,017	10,436	119,985
			3	2,820	8,315	2,551	29,330
			4	5,384	15,875	4,870	55,993
Professionals 02	CR 1	CC 2	1	170,393	14,501	13,364	41,759
			2	76,133	6,479	5,971	18,658
			3	79,758	6,788	6,256	19,547
			4	36,254	3,085	2,834	8,885
	CR 1	SC 6	1	11,845	5,710	3,489	31,503
			2	5,293	2,551	1,559	14,076
			3	5,545	2,673	1,633	14,746
			4	2,520	1,215	742	6,702
	SR 5	CC 2	1	47,282	35,661	14,490	40,366
			2	21,126	15,933	6,474	18,036
			3	22,132	16,692	6,782	18,895
			4	10,060	7,587	3,083	8,589
	SR 5	SC 6	1	8,806	65,332	18,812	263,140
			2	3,934	29,191	8,405	117,573
			3	4,122	30,581	8,805	123,172
			4	1,874	13,901	4,002	55,987
Sales workers 03	CR 1	CC 2	1	33,250	4,442	4,000	11,364
			2	16,238	2,169	1,953	5,550
			3	3,866	517	465	1,321
			4	6,959	930	837	2,378
			5	17,011	2,273	2,046	5,814
	CR 1	SC 6	1	2,312	1,749	1,044	8,573
			2	1,129	854	510	4,187
			3	269	203	121	997
			4	484	366	219	1,794
			5	1,183	895	534	4,386

(continued)

TABLE C-4 (CONT'D). COHORT POPULATIONS BY STUDY AREA

Cohort description				Cohort population			
A-O group	Home NT[a]	Work NT[a]	Subgroup	Chicago	Philadelphia	St. Louis	Los Angeles
Sales workers 03 (cont.)	SR 5	CC 2	1	9,244	11,322	4,315	11,372
			2	4,514	5,529	2,107	5,554
			3	1,073	1,317	502	1,322
			4	1,932	2,370	903	2,380
			5	4,722	5,792	2,208	5,818
	SR 5	SC 6	1	1,719	20,742	5,602	74,133
			2	839	10,130	2,736	36,204
			3	200	2,412	651	8,620
			4	360	4,341	1,173	15,516
			5	879	10,612	2,866	37,928
Clerical workers 04	CR 1	CC 2	1	141,163	26,033	22,242	48,231
			2	65,540	12,087	10,327	22,393
			3	22,687	4,184	3,575	7,751
			4	10,083	1,860	1,589	3,445
			5	2,520	465	397	861
			6	10,083	1,860	1,589	3,445
	CR 1	SC 6	1	9,813	10,250	5,806	36,385
			2	4,556	4,759	2,696	16,893
			3	1,577	1,647	933	5,848
			4	701	732	415	2,599
			5	175	183	104	650
			6	701	732	415	2,599
	SR 5	CC 2	1	31,571	39,508	11,765	36,537
			2	14,658	18,343	5,462	16,963
			3	5,074	6,349	1,891	5,872
			4	2,255	2,822	840	2,609
			5	564	706	210	652
			6	2,255	2,822	840	2,609
	SR 5	SC 6	1	5,880	72,380	15,274	238,175
			2	2,730	33,605	7,092	110,175
			3	945	11,633	2,455	38,278
			4	420	5,170	1,091	17,013
			5	105	1,293	273	4,253
			6	420	5,170	1,091	17,013

(continued)

TABLE C-4 (CONT'D). COHORT POPULATIONS BY STUDY AREA

Cohort description				Cohort population			
A-O group	Home NT[a]	Work NT[a]	Sub-group	Chicago	Phila-delphia	St. Louis	Los Angeles
Craftsmen 05	CR	CI	1	81,648	14,010	9,562	18,978
	1	3	2	39,191	6,725	4,590	9,109
			3	16,330	2,802	1,912	3,796
			4	3,266	560	382	759
			5	6,532	1,121	765	1,518
			6	16,329	2,802	1,912	3,796
	CR	SI	1	5,676	5,516	2,496	14,317
	1	7	2	2,725	2,648	1,198	6,872
			3	1,135	1,103	499	2,863
			4	227	221	100	573
			5	454	441	200	1,145
			6	1,135	1,103	499	2,863
	SR	CI	1	25,626	20,533	6,018	22,170
	5	3	2	12,300	9,856	2,889	10,641
			3	5,125	4,107	1,204	4,434
			4	1,025	821	241	887
			5	2,050	1,643	481	1,774
			6	5,125	4,107	1,204	4,434
	SR	SI	1	4,772	37,618	7,813	144,520
	5	7	2	2,291	18,056	3,750	69,370
			3	954	7,524	1,563	28,904
			4	191	1,505	313	5,781
			5	382	3,009	625	11,562
			6	954	7,524	1,563	28,904
Laborers 06	CR	CI	1	75,251	27,638	19,542	29,939
	1	3	2	34,731	12,756	9,020	13,818
			3	11,577	4,252	3,007	4,606
			4	5,789	2,126	150	2,303
			5	34,731	12,756	9,020	13,818
			6	30,872	11,339	8,017	12,283
	CR	SI	1	5,231	10,882	19,542	22,586
	1	7	2	2,414	5,022	2,354	10,424
			3	805	1,674	785	3,475
			4	402	837	392	1,737
			5	2,414	5,022	2,354	10,424
			6	2,146	4,464	2,093	9,266

(continued)

TABLE C-4 (CONT'D). COHORT POPULATIONS BY STUDY AREA

Cohort description				Cohort population			
A-O group	Home NT[a]	Work NT[a]	Sub-group	Chicago	Phila-delphia	St. Louis	Los Angeles
Laborers 06 (cont.)	SR 5	CI 3	1	18,289	22,294	6,791	24,843
			2	8,441	10,289	3,134	11,466
			3	2,813	3,430	1.045	3,822
			4	1,406	1,715	522	1,911
			5	8,441	10,289	3,134	11,466
			6	7,503	9,146	2,786	10,192
	SR 5	SI 7	1	3,406	40,843	8,817	161,945
			2	1,572	18,851	4,069	74,744
			3	524	6,284	1,356	24,914
			4	262	3,142	678	12,457
			5	1,572	18,851	4,069	74,744
			6	1,397	16,756	3,617	66,439
Service workers 08	CR 1	CR 1	1	49,393	20,770	16,789	25,910
			2	23,324	9,808	7,928	12,235
			3	30,184	12,693	10,260	15,834
			4	4,116	1,731	1,399	2,159
			5	19,208	8,077	6,529	10,076
			6	10,976	4,616	3,731	5,758
	SR 5	SR 5	1	11,090	37,142	9,416	115,759
			2	5,236	17,539	4,446	54,664
			3	6,777	22,698	5,754	70,741
			4	924	3,095	785	9,647
			5	4,312	14,444	3,662	45,017
			6	2,464	8,254	2,092	25,724
Housewives 09	CR 1	CR 1	1	71,488	39,106	27,469	69,865
			2	83,402	45,624	32,047	81,509
			3	15,319	8,380	5,886	14,971
	SR 5	SR 5	1	38,824	122,142	34,182	340,320
			2	45,295	142,499	39,879	397,040
			3	8,320	26,173	7,325	72,926
Retired 10	CR 1	CR 1	1	11,480	19,396	17,534	40,520
			2	13,776	23,275	21,040	48,624
			3	11,480	19,396	17,534	40,520
			4	17,219	29,093	26,300	60,781
			5	2,296	3,879	3,507	8,104
			6	1,148	1,940	1,753	4,052

(continued)

TABLE C-4 (CONT'D). COHORT POPULATIONS BY STUDY AREA

Cohort description				Cohort population			
A-O group	Home NT[a]	Work NT[a]	Sub-group	Chicago	Phila-delphia	St. Louis	Los Angeles
Retired 10 (cont.)	SR 5	SR 5	1	3,277	42,411	10,836	112,631
			2	3,933	50,893	13,003	135,157
			3	3,277	42,411	10,836	112,631
			4	4,916	63,617	16,254	168,946
			5	655	8,482	2,167	22,526
			6	327	4,241	1,084	11,263
Children <5 11	CR 1	CR 1	1	10,562	15,851	10,494	24,304
			2	10,059	15,096	9,995	23,146
			3	10,059	15,096	9,995	23,146
			4	19,615	29,438	19,489	45,135
	SR 5	SR 5	1	8,076	35,021	10,506	113,151
			2	7,691	33,353	10,006	107,763
			3	7,691	33,353	10,006	107,763
			4	14,997	65,039	19,511	210,137
Children 5-17 12	CR 1	CR 1	1	67,594	117,289	82,690	149,881
			2	4,828	8,378	5,906	10,706
			3	8,449	14,661	10,336	18,735
			4	31,383	54,455	38,391	69,587
			5	2,414	4,189	2,953	5,353
			6	6,035	10,472	7,383	13,382
	SR 5	SR 5	1	51,683	284,616	91,294	905,879
			2	3,692	20,330	6,521	64,706
			3	6,460	35,577	11,412	113,235
			4	23,996	132,143	42,387	420,587
			5	1,846	10,165	3,261	32,353
			6	4,615	25,412	8,151	80,882

TABLE C-5. FRACTION OF CHICAGO POPULATION IN EACH N/M TYPE FOR WEEKDAYS

CITY IS CHICAGO DAY IS WKD POPULATION IS 2364970.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.7046	.7172	.7274	.7320	.7320	.7320	.6846	.5089	.2774	.2409	.2126	.2338	1.1.
PM	.2877	.2393	.2060	.2456	.2409	.5572	.6813	.6659	.7087	.7087	.7087	.7046	1.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0334	.1058	.0282	.0091	.0248	.0043	1.3.
PM	0.0000	.0074	.0528	.0158	.0455	.0506	.0075	0.0000	0.0000	0.0000	0.0000	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0031	0.0000	.0058	0.0000	.0017	1.4.
PM	.0049	.0121	.0121	.0020	.0010	.0157	.0199	.0427	0.0000	0.0000	0.0000	0.0000	1.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0378	.0562	.0538	1.5.
PM	.0010	.0348	.0226	.0302	.0543	.0241	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	.0170	.0170	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.3347	.3425	.3295	.3439	2.1.
PM	.3511	.3295	.3387	.3477	.3607	.0170	.0170	.0170	.0170	.0170	.0170	.0170	2.1.
AM	0.0000	0.0000	.0052	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0052	.0129	0.0000	2.3.
PM	0.0000	.0195	0.0000	0.0000	0.0000	.0715	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0021	.0034	.0065	.0034	2.4.
PM	0.0000	.0021	.0086	.0013	.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0021	.0038	2.5.
PM	0.0000	0.0000	.0038	.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	.0200	.0049	.0049	.0049	.0049	.0049	.0049	.1249	.1523	.1340	.1249	.1502	3.1.
PM	.1559	.1286	.1594	.1340	.0242	.0152	.0152	.0152	.0152	.0152	.0152	.0200	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0162	.0162	.0162	.0162	0.0000	0.0000	3.3.
PM	.0162	.0162	0.0000	.0162	.0563	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0381	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0036	.0219	.0091	.0219	3.5.
PM	0.0000	.0273	.0127	.0219	.0219	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.2550	.2590	.2616	.2627	.2627	.2627	.2485	.1942	.1237	.1066	.0946	.0959	5.1.
PM	.1319	.1162	.0996	.1095	.0892	.2095	.2479	.2417	.2562	.2562	.2562	.2550	5.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0104	.0311	.0140	.0046	.0083	.0033	5.3.
PM	0.0000	.0026	.0221	.0091	.0219	.0144	.0023	0.0000	0.0000	0.0000	0.0000	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0023	0.0000	.0017	0.0000	.0004	5.4.
PM	.0014	.0032	.0035	.0016	.0008	.0042	.0061	.0145	0.0000	0.0000	0.0000	0.0000	5.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0211	.0311	.0345	5.5.
PM	.0008	.0121	.0088	.0138	.0377	.0111	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	.0015	.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0313	.0321	.0308	.0322	6.1.
PM	.0329	.0308	.0317	.0325	.0337	.0015	.0015	.0015	.0015	.0015	.0015	.0015	6.1.
AM	0.0000	0.0000	.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0005	.0012	0.0000	6.3.
PM	0.0000	.0018	0.0000	0.0000	0.0000	.0066	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0002	.0003	.0006	.0003	6.4.
PM	0.0000	.0002	.0008	.0001	.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0002	.0004	6.5.
PM	0.0000	0.0000	.0004	.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	.0019	.0005	.0005	.0005	.0005	.0005	.0005	.0119	.0144	.0128	.0119	.0143	7.1.
PM	.0148	.0122	.0151	.0128	.0023	.0014	.0014	.0014	.0014	.0014	.0014	.0019	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0015	.0015	.0015	.0015	0.0000	0.0000	7.3.
PM	.0015	.0015	0.0000	.0015	.0053	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0035	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0004	.0020	.0009	.0020	7.5.
PM	0.0000	.0026	.0012	.0020	.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-6. FRACTION OF CHICAGO POPULATION IN EACH N/M TYPE FOR SATURDAYS

CITY IS CHICAGO DAY IS SAT POPULATION IS 2364970.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.7361	.7361	.7361	.7361	.7361	.7361	.7361	.7361	.7329	.4638	.3630	.6537	1.1.
PM	.6825	.5841	.3099	.4493	.6686	.6975	.7244	.5967	.6605	.7335	.7296	.7361	1.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1466	.0352	.0166	1.3.
PM	.0504	.0949	.1678	.0152	.0255	.0074	.0011	.0941	.0697	.0026	.0065	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0049	.1455	.0017	1.4.
PM	0.0000	.0214	.1027	.0471	.0210	.0312	.0074	.0453	.0058	0.0000	0.0000	0.0000	1.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1177	.1893	.0609	1.5.
PM	0.0000	.0326	.1525	.2213	.0210	0.0000	.0031	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0038	0.0000	0.0000	.0038	2.1.
PM	.0038	0.0000	0.0000	.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0038	0.0000	0.0000	2.3.
PM	0.0000	0.0000	.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0038	0.0000	2.5.
PM	0.0000	.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.2639	.2639	.2639	.2639	.2639	.2639	.2639	.2639	.2629	.1711	.1385	.2307	5.1.
PM	.2475	.1983	.0967	.1603	.2388	.2531	.2601	.2055	.2363	.2620	.2604	.2639	5.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0417	.0236	.0050	5.3.
PM	.0155	.0381	.0503	.0058	.0107	.0026	.0003	.0379	.0260	.0020	.0035	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0014	.0443	.0004	5.4.
PM	0.0000	.0120	.0429	.0129	.0062	.0082	.0026	.0205	.0017	0.0000	0.0000	0.0000	5.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0487	.0565	.0268	5.5.
PM	0.0000	.0146	.0731	.0839	.0083	0.0000	.0010	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0004	0.0000	0.0000	.0004	6.1.
PM	.0004	0.0000	0.0000	.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0004	0.0000	0.0000	6.3.
PM	0.0000	0.0000	.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0004	0.0000	6.5.
PM	0.0000	.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-7. FRACTION OF CHICAGO POPULATION IN EACH N/M TYPE FOR SUNDAYS

					CITY IS	CHICAGO	DAY IS SUN		POPULATION IS	2364970.			
HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.7361	.7318	.7361	.7314	.7361	.7361	.7361	.7228	.6628	.6434	.5177	.6078	1.1.
PM	.7000	.6200	.4113	.3421	.5396	.6908	.6869	.7206	.7076	.7361	.7361	.7361	1.1.
AM	0.0000	0.0000	0.0000	.0043	0.0000	0.0000	0.0000	.0133	.0687	.0833	.2064	.0989	1.3.
PM	.0361	.0391	.0080	.0030	.0289	0.0000	.0075	.0155	.0285	0.0000	0.0000	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0084	.0053	1.4.
PM	0.0000	.0239	.0443	.0410	.0283	.0407	.0418	0.0000	0.0000	0.0000	0.0000	0.0000	1.4.
AM	0.0000	.0043	0.0000	.0005	0.0000	0.0000	0.0000	0.0000	.0046	.0094	.0036	.0241	1.5.
PM	0.0000	.0551	.2694	.3469	.1361	.0046	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
PM	0.0000	0.0000	0.0000	0.0000	.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
PM	0.0000	0.0000	.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
PM	0.0000	0.0000	0.0000	.0038	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.2639	.2607	.2639	.2605	.2639	.2639	.2639	.2538	.2332	.2204	.1994	.2189	5.1.
PM	.2528	.2246	.1505	.1257	.1796	.2523	.2474	.2595	.2568	.2639	.2639	.2639	5.1.
AM	0.0000	0.0000	0.0000	.0033	0.0000	0.0000	0.0000	.0101	.0296	.0410	.0594	.0350	5.3.
PM	.0111	.0113	.0040	.0010	.0146	0.0000	.0023	.0044	.0071	0.0000	0.0000	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0024	.0033	5.4.
PM	0.0000	.0073	.0154	.0125	.0073	.0104	.0142	0.0000	0.0000	0.0000	0.0000	0.0000	5.4.
AM	0.0000	.0033	0.0000	.0001	0.0000	0.0000	0.0000	0.0000	.0011	.0025	.0027	.0067	5.5.
PM	0.0000	.0207	.0930	.1237	.0615	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
PM	0.0000	0.0000	0.0000	0.0000	.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
PM	0.0000	0.0000	.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
PM	0.0000	0.0000	0.0000	.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-8. FRACTION OF PHILADELPHIA POPULATION IN EACH N/M TYPE FOR WEEKDAYS

CITY IS PHILADELPH DAY IS WKD POPULATION IS 2935233.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.2689	.2722	.2742	.2751	.2751	.2751	.2604	.2186	.1794	.1565	.1234	.1448	1.1.
PM	.1872	.1648	.1358	.1540	.1255	.2324	.2653	.2555	.2701	.2701	.2701	.2689	1.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0093	.0191	.0176	.0118	.0182	.0051	1.3.
PM	0.0000	.0013	.0263	.0123	.0177	.0081	.0013	0.0000	0.0000	0.0000	0.0000	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0043	0.0000	.0079	0.0000	.0006	1.4.
PM	.0066	.0094	.0165	.0029	.0014	.0061	.0035	.0146	0.0000	0.0000	0.0000	0.0000	1.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0191	.0536	.0448	1.5.
PM	.0014	.0197	.0167	.0261	.0651	.0142	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	.0052	.0052	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0786	.0809	.0770	.0814	2.1.
PM	.0835	.0770	.0798	.0823	.0865	.0052	.0052	.0052	.0052	.0052	.0052	.0052	2.1.
AM	0.0000	0.0000	.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0016	.0039	0.0000	2.3.
PM	0.0000	.0059	0.0000	0.0000	0.0000	.0194	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0006	.0010	.0020	.0010	2.4.
PM	0.0000	.0006	.0026	.0004	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0006	.0011	2.5.
PM	0.0000	0.0000	.0011	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	.0068	.0018	.0018	.0018	.0018	.0018	.0018	.0423	.0525	.0446	.0423	.0516	3.1.
PM	.0534	.0432	.0571	.0446	.0073	.0050	.0050	.0050	.0050	.0050	.0050	.0068	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0070	.0070	.0070	.0070	0.0000	0.0000	3.3.
PM	.0070	.0070	0.0000	.0070	.0205	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0158	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0009	.0088	.0024	.0088	3.5.
PM	0.0000	.0102	.0033	.0088	.0088	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.7051	.7124	.7185	.7212	.7212	.7212	.6929	.5798	.4434	.3804	.3115	.3526	5.1.
PM	.4628	.4034	.3372	.3866	.2908	.5975	.6877	.6704	.7075	.7075	.7075	.7051	5.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0194	.0639	.0460	.0258	.0381	.0114	5.3.
PM	0.0000	.0040	.0670	.0315	.0552	.0249	.0054	0.0000	0.0000	0.0000	0.0000	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0104	0.0000	.0173	0.0000	.0011	5.4.
PM	.0144	.0211	.0361	.0069	.0035	.0099	.0144	.0372	0.0000	0.0000	0.0000	0.0000	5.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0572	.1312	.1157	5.5.
PM	.0035	.0522	.0404	.0557	.1593	.0393	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	.0065	.0065	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1061	.1096	.1041	.1101	6.1.
PM	.1131	.1041	.1080	.1117	.1167	.0065	.0065	.0065	.0065	.0065	.0065	.0065	6.1.
AM	0.0000	0.0000	.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0020	.0055	0.0000	6.3.
PM	0.0000	.0080	0.0000	0.0000	0.0000	.0259	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0009	.0014	.0025	.0014	6.4.
PM	0.0000	.0009	.0034	.0005	.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0009	.0016	6.5.
PM	0.0000	0.0000	.0016	.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	.0076	.0019	.0019	.0019	.0019	.0019	.0019	.0475	.0586	.0504	.0475	.0577	7.1.
PM	.0598	.0487	.0629	.0504	.0086	.0057	.0057	.0057	.0057	.0057	.0057	.0076	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0072	.0072	.0072	.0072	0.0000	0.0000	7.3.
PM	.0072	.0072	0.0000	.0072	.0224	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0165	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0012	.0093	.0029	.0093	7.5.
PM	0.0000	.0111	.0041	.0093	.0093	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-9. FRACTION OF PHILADELPHIA POPULATION IN EACH N/M TYPE FOR SATURDAYS

CITY IS PHILADELPH DAY IS SAT POPULATION IS 2935233.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.2763	.2763	.2763	.2763	.2763	.2763	.2763	.2763	.2759	.1792	.1518	.2357	1.1.
PM	.2700	.2065	.0776	.1456	.2468	.2650	.2744	.2146	.2460	.2728	.2735	.2763	1.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0458	.0472	.0041	1.3.
PM	.0059	.0300	.0424	.0082	.0146	.0013	.0002	.0428	.0224	.0036	.0029	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0066	.0396	.0006	1.4.
PM	0.0000	.0213	.0439	.0310	.0023	.0101	.0013	.0189	.0079	0.0000	0.0000	0.0000	1.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0444	.0374	.0355	1.5.
PM	0.0000	.0182	.1120	.0912	.0126	0.0000	.0004	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0011	0.0000	0.0000	.0011	2.1.
PM	.0011	0.0000	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0011	0.0000	0.0000	2.3.
PM	0.0000	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0011	0.0000	2.5.
PM	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.7237	.7237	.7237	.7237	.7237	.7237	.7237	.7237	.7214	.4747	.3806	.6128	5.1.
PM	.6944	.5400	.2225	.3996	.6562	.7003	.7167	.5554	.6410	.7150	.7147	.7237	5.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1099	.1125	.0142	5.3.
PM	.0270	.0881	.1089	.0180	.0326	.0040	.0007	.1171	.0653	.0087	.0089	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0144	.1111	.0011	5.4.
PM	0.0000	.0499	.1168	.0605	.0100	.0194	.0040	.0511	.0173	0.0000	0.0000	0.0000	5.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1223	.1172	.0932	5.5.
PM	0.0000	.0434	.2730	.2432	.0248	0.0000	.0023	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0016	0.0000	0.0000	.0016	6.1.
PM	.0016	0.0000	0.0000	.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0016	0.0000	0.0000	6.3.
PM	0.0000	0.0000	.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0016	0.0000	6.5.
PM	0.0000	.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-10. FRACTION OF PHILAEDLPHIA POPULATION IN EACH N/M TYPE FOR SUNDAYS

```
                                           CITY IS PHILADELPH     DAY IS SUN     POPULATION IS    2935233.
HOUR       1        2        3        4        5        6        7        8        9        10       11       12     N/M

 AM     .2763    .2712    .2763    .2705    .2763    .2763    .2763    .2578    .2507    .1868    .2235    .2350 1.1.
 PM     .2731    .2359    .1516    .1244    .1748    .2598    .2618    .2723    .2660    .2763    .2763    .2763 1.1.
 AM    0.0000   0.0000   0.0000    .0051   0.0000   0.0000   0.0000    .0186    .0248    .0821    .0389    .0306 1.3.
 PM     .0032    .0077    .0031    .0005    .0166   0.0000    .0013    .0041    .0104   0.0000   0.0000   0.0000 1.3.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000    .0089    .0052 1.4.
 PM    0.0000    .0028    .0080    .0099    .0084    .0157    .0133   0.0000   0.0000   0.0000   0.0000   0.0000 1.4.
 AM    0.0000    .0051   0.0000    .0007   0.0000   0.0000   0.0000   0.0000    .0009    .0075    .0050    .0056 1.5.
 PM    0.0000    .0300    .1132    .1411    .0761    .0009   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 1.5.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 2.1.
 PM    0.0000   0.0000   0.0000   0.0000    .0011   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 2.1.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 2.3.
 PM    0.0000   0.0000    .0011   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 2.3.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 2.4.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 2.4.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 2.5.
 PM    0.0000   0.0000   0.0000    .0011   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 2.5.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 3.1.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 3.1.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 3.3.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 3.3.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 3.4.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 3.4.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 3.5.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 3.5.
 AM     .7237    .7123    .7237    .7108    .7237    .7237    .7237    .6786    .6529    .5209    .5848    .6026 5.1.
 PM     .7075    .6240    .4051    .3270    .4628    .6826    .6840    .7148    .7060    .7237    .7237    .7237 5.1.
 AM    0.0000   0.0000   0.0000    .0114   0.0000   0.0000   0.0000    .0450    .0680    .1856    .1078    .0912 5.3.
 PM     .0161    .0274    .0097    .0016    .0408   0.0000    .0054    .0089    .0177   0.0000   0.0000   0.0000 5.3.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000    .0190    .0134 5.4.
 PM    0.0000    .0127    .0238    .0311    .0166    .0383    .0343   0.0000   0.0000   0.0000   0.0000   0.0000 5.4.
 AM    0.0000    .0114   0.0000    .0314   0.0000   0.0000   0.0000   0.0000    .0027    .0172    .0121    .0165 5.5.
 PM    0.0000    .0595    .2828    .3617    .2011    .0027   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 5.5.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 6.1.
 PM    0.0000   0.0000   0.0000   0.0000    .0016   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 6.1.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 6.3.
 PM    0.0000   0.0000    .0016   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 6.3.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 6.4.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 6.4.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 6.5.
 PM    0.0000   0.0000   0.0000    .0016   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 6.5.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 7.1.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 7.1.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 7.3.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 7.3.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 7.4.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 7.4.
 AM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 7.5.
 PM    0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000   0.0000 7.5.


N = 1 = CENTER CITY RESIDENTIAL    N = 5 = SUBURBAN RESIDENTIAL    M = 1 = INDOORS      M = 5 = OUTDOORS
    2 = CENTER CITY COMMERCIAL         6 = SUBURBAN COMMERCIAL         3 = VEHICLE
    3 = CENTER CITY INDUSTRIAL         7 = SUBURBAN INDUSTRIAL         4 = ROADSIDE
```

TABLE C-11. FRACTION OF ST. LOUIS POPULATION IN EACH N/M TYPE FOR WEEKDAYS

CITY IS ST. LOUIS DAY IS WKD POPULATION IS 1219561.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.4903	.4954	.4991	.5007	.5007	.5007	.4784	.3939	.3241	.2783	.2196	.2663	1.1.
PM	.3337	.2881	.2345	.2777	.2401	.4227	.4809	.4640	.4912	.4912	.4912	.4903	1.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0141	.0361	.0298	.0226	.0354	.0082	1.3.
PM	0.0000	.0020	.0470	.0209	.0305	.0160	.0028	0.0000	0.0000	0.0000	0.0000	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0073	0.0000	.0173	0.0000	.0011	1.4.
PM	.0144	.0200	.0359	.0048	.0024	.0093	.0075	.0271	0.0000	0.0000	0.0000	0.0000	1.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0323	.0954	.0748	1.5.
PM	.0024	.0403	.0330	.0470	.1106	.0254	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	.0065	.0065	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1016	.1045	.0996	.1050	2.1.
PM	.1078	.0996	.1031	.1065	.1115	.0065	.0065	.0065	.0065	.0065	.0065	.0065	2.1.
AM	0.0000	0.0000	.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0020	.0049	0.0000	2.3.
PM	0.0000	.0074	0.0000	0.0000	0.0000	.0246	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0008	.0013	.0025	.0013	2.4.
PM	0.0000	.0008	.0033	.0005	.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0008	.0014	2.5.
PM	0.0000	0.0000	.0014	.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	.0069	.0011	.0011	.0011	.0011	.0011	.0011	.0505	.0630	.0530	.0505	.0619	3.1.
PM	.0640	.0515	.0693	.0530	.0084	.0059	.0059	.0059	.0059	.0059	.0059	.0069	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0089	.0089	.0089	.0089	0.0000	0.0000	3.3.
PM	.0089	.0089	0.0000	.0089	.0250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0198	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0010	.0110	.0026	.0110	3.5.
PM	0.0000	.0125	.0036	.0110	.0110	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.4876	.4918	.4954	.4970	.4970	.4970	.4804	.4044	.3095	.2700	.2154	.2442	5.1.
PM	.3256	.2859	.2443	.2708	.1916	.4108	.4744	.4670	.4890	.4890	.4890	.4876	5.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0113	.0453	.0339	.0171	.0246	.0082	5.3.
PM	0.0000	.0023	.0435	.0231	.0370	.0181	.0040	0.0000	0.0000	0.0000	0.0000	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0080	0.0000	.0107	0.0000	.0006	5.4.
PM	.0089	.0129	.0222	.0053	.0027	.0059	.0106	.0220	0.0000	0.0000	0.0000	0.0000	5.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0394	.0971	.0841	5.5.
PM	.0027	.0361	.0271	.0378	.1222	.0299	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	.0040	.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0736	.0763	.0723	.0763	6.1.
PM	.0784	.0723	.0751	.0775	.0806	.0040	.0040	.0040	.0040	.0040	.0040	.0040	6.1.
AM	0.0000	0.0000	.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0012	.0039	0.0000	6.3.
PM	0.0000	.0055	0.0000	0.0000	0.0000	.0174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0006	.0009	.0015	.0009	6.4.
PM	0.0000	.0006	.0022	.0003	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0006	.0011	6.5.
PM	0.0000	0.0000	.0011	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	.0047	.0012	.0012	.0012	.0012	.0012	.0012	.0410	.0480	.0427	.0410	.0474	7.1.
PM	.0487	.0417	.0510	.0427	.0051	.0034	.0034	.0034	.0034	.0034	.0034	.0047	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0047	.0047	.0047	.0047	0.0000	0.0000	7.3.
PM	.0047	.0047	0.0000	.0047	.0140	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0106	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0007	.0059	.0017	.0059	7.5.
PM	0.0000	.0070	.0024	.0059	.0059	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-12. FRACTION OF ST. LOUIS POPULATION IN EACH N/M TYPE FOR SATURDAYS

CITY IS ST. LOUIS DAY IS SAT POPULATION IS 1219561.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.5016	.5016	.5016	.5016	.5016	.5016	.5016	.5016	.5007	.3285	.2750	.4282	1.1.
PM	.4885	.3828	.1380	.2554	.4531	.4835	.4983	.3941	.4446	.4955	.4968	.5016	1.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0810	.0833	.0088	1.3.
PM	.0122	.0526	.0877	.0140	.0239	.0020	.0004	.0763	.0397	.0061	.0048	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0144	.0720	.0011	1.4.
PM	0.0000	.0368	.0775	.0709	.0046	.0161	.0020	.0312	.0173	0.0000	0.0000	0.0000	1.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0768	.0704	.0626	1.5.
PM	0.0000	.0285	.1975	.1604	.0199	0.0000	.0009	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0014	0.0000	0.0000	.0014	2.1.
PM	.0014	0.0000	0.0000	.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0014	0.0000	0.0000	2.3.
PM	0.0000	0.0000	.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0014	0.0000	2.5.
PM	0.0000	.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.4984	.4984	.4984	.4984	.4984	.4984	.4984	.4984	.4967	.3362	.2567	.4164	5.1.
PM	.4760	.3680	.1485	.2780	.4521	.4847	.4940	.3821	.4458	.4917	.4924	.4984	5.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0660	.0844	.0101	5.3.
PM	.0208	.0610	.0759	.0121	.0222	.0023	.0004	.0826	.0420	.0067	.0060	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0089	.0724	.0006	5.4.
PM	0.0000	.0378	.0772	.0368	.0074	.0114	.0023	.0337	.0107	0.0000	0.0000	0.0000	5.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0856	.0832	.0695	5.5.
PM	0.0000	.0300	.1951	.1697	.0168	0.0000	.0017	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0011	0.0000	0.0000	.0011	6.1.
PM	.0011	0.0000	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0011	0.0000	0.0000	6.3.
PM	0.0000	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0011	0.0000	6.5.
PM	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-13. FRACTION OF ST. LOUIS POPULATION IN EACH N/M TYPE FOR SUNDAYS

CITY IS ST. LOUIS   DAY IS SUN   POPULATION IS 1219561.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.5016	.4934	.5016	.4920	.5016	.5016	.5016	.4701	.4596	.3370	.3959	.4273	1.1.
PM	.4951	.4222	.2720	.2227	.3268	.4689	.4745	.4943	.4838	.5016	.5016	.5016	1.1.
AM	0.0000	0.0000	0.0000	.0082	0.0000	0.0000	0.0000	.0315	.0403	.1486	.0795	.0539	1.3.
PM	.0065	.0155	.0052	.0008	.0271	0.0000	.0028	.0073	.0177	0.0000	0.0000	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0177	.0090	1.4.
PM	0.0000	.0057	.0119	.0210	.0157	.0310	.0243	0.0000	0.0000	0.0000	0.0000	0.0000	1.4.
AM	0.0000	.0082	0.0000	.0014	0.0000	0.0000	0.0000	0.0000	.0016	.0160	.0085	.0114	1.5.
PM	0.0000	.0581	.2116	.2562	.1311	.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
PM	0.0000	0.0000	0.0000	0.0000	.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
PM	0.0000	0.0000	.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
PM	0.0000	0.0000	0.0000	.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.4984	.4902	.4984	.4893	.4984	.4984	.4984	.4637	.4528	.3550	.4036	.4177	5.1.
PM	.4856	.4288	.2874	.2145	.3117	.4739	.4742	.4931	.4878	.4984	.4984	.4984	5.1.
AM	0.0000	0.0000	0.0000	.0082	0.0000	0.0000	0.0000	.0348	.0440	.1329	.0738	.0589	5.3.
PM	.0128	.0197	.0065	.0009	.0300	0.0000	.0040	.0053	.0106	0.0000	0.0000	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0116	.0103	5.4.
PM	0.0000	.0098	.0136	.0220	.0100	.0229	.0202	0.0000	0.0000	0.0000	0.0000	0.0000	5.4.
AM	0.0000	.0082	0.0000	.0009	0.0000	0.0000	0.0000	0.0000	.0016	.0105	.0094	.0116	5.5.
PM	0.0000	.0401	.1892	.2593	.1450	.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
PM	0.0000	0.0000	0.0000	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
PM	0.0000	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
PM	0.0000	0.0000	0.0000	.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-14. FRACTION OF LOS ANGELES POPULATION IN EACH N/M TYPE FOR WEEKDAYS

CITY IS LOS ANGELE DAY IS WKD POPULATION IS 7719108.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.1832	.1851	.1869	.1877	.1877	.1877	.1797	.1500	.1119	.0948	.0797	.0931	1.1.
PM	.1157	.0962	.0775	.0976	.0821	.1544	.1764	.1733	.1839	.1839	.1839	.1832	1.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0052	.0172	.0118	.0082	.0118	.0030	1.3.
PM	0.0000	.0009	.0175	.0066	.0127	.0068	.0020	0.0000	0.0000	0.0000	0.0000	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0021	0.0000	.0063	0.0000	.0003	1.4.
PM	.0052	.0074	.0131	.0014	.0007	.0031	.0054	.0106	0.0000	0.0000	0.0000	0.0000	1.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0123	.0301	.0253	1.5.
PM	.0007	.0172	.0136	.0161	.0337	.0099	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	.0025	.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0439	.0452	.0431	.0454	2.1.
PM	.0465	.0431	.0446	.0460	.0480	.0025	.0025	.0025	.0025	.0025	.0025	.0025	2.1.
AM	0.0000	0.0000	.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0008	.0021	0.0000	2.3.
PM	0.0000	.0031	0.0000	0.0000	0.0000	.0103	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0003	.0005	.0010	.0005	2.4.
PM	0.0000	.0003	.0013	.0002	.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0003	.0006	2.5.
PM	0.0000	0.0000	.0006	.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	.0029	.0008	.0008	.0008	.0008	.0008	.0008	.0183	.0226	.0193	.0183	.0222	3.1.
PM	.0230	.0187	.0244	.0193	.0032	.0022	.0022	.0022	.0022	.0022	.0022	.0029	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0029	.0029	.0029	.0029	0.0000	0.0000	3.3.
PM	.0029	.0029	0.0000	.0029	.0087	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0066	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0004	.0037	.0011	.0037	3.5.
PM	0.0000	.0043	.0015	.0037	.0037	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.7926	.8007	.8064	.8089	.8089	.8089	.7775	.6518	.5057	.4445	.3548	.4031	5.1.
PM	.5337	.4661	.3986	.4425	.3276	.6704	.7687	.7562	.7953	.7953	.7953	.7926	5.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0215	.0700	.0554	.0286	.0426	.0140	5.3.
PM	0.0000	.0043	.0713	.0367	.0590	.0288	.0073	0.0000	0.0000	0.0000	0.0000	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0126	0.0000	.0175	0.0000	.0012	5.4.
PM	.0146	.0213	.0365	.0084	.0042	.0112	.0193	.0391	0.0000	0.0000	0.0000	0.0000	5.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0619	.1552	.1342	5.5.
PM	.0042	.0608	.0461	.0649	.1937	.0491	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	.0083	.0083	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1517	.1569	.1492	.1572	6.1.
PM	.1613	.1492	.1547	.1595	.1658	.0083	.0083	.0083	.0083	.0083	.0083	.0083	6.1.
AM	0.0000	0.0000	.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0025	.0077	0.0000	6.3.
PM	0.0000	.0109	0.0000	0.0000	0.0000	.0353	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0012	.0019	.0032	.0019	6.4.
PM	0.0000	.0012	.0044	.0006	.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0012	.0022	6.5.
PM	0.0000	0.0000	.0022	.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	.0105	.0027	.0027	.0027	.0027	.0027	.0027	.0654	.0805	.0695	.0654	.0793	7.1.
PM	.0822	.0670	.0862	.0695	.0119	.0078	.0078	.0078	.0078	.0078	.0078	.0105	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0098	.0098	.0098	.0098	0.0000	0.0000	7.3.
PM	.0098	.0098	0.0000	.0098	.0307	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0225	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0016	.0127	.0041	.0127	7.5.
PM	0.0000	.0151	.0058	.0127	.0127	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-15. FRACTION OF LOS ANGELES POPULATION IN EACH N/M TYPE FOR SATURDAYS

CITY IS LOS ANGELE DAY IS SAT POPULATION IS 7719108.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.1884	.1884	.1884	.1884	.1884	.1884	.1884	.1884	.1878	.1205	.1008	.1597	1.1.
PM	.1792	.1453	.0614	.1028	.1698	.1815	.1868	.1480	.1663	.1866	.1864	.1884	1.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0321	.0249	.0053	1.3.
PM	.0086	.0213	.0318	.0048	.0089	.0009	.0002	.0283	.0157	.0017	.0019	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0052	.0302	.0003	1.4.
PM	0.0000	.0103	.0277	.0210	.0028	.0059	.0009	.0120	.0063	0.0000	0.0000	0.0000	1.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0299	.0319	.0225	1.5.
PM	0.0000	.0109	.0669	.0592	.0068	0.0000	.0005	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0006	0.0000	0.0000	.0006	2.1.
PM	.0006	0.0000	0.0000	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0006	0.0000	0.0000	2.3.
PM	0.0000	0.0000	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0006	0.0000	2.5.
PM	0.0000	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.8116	.8116	.8116	.8116	.8116	.8116	.8116	.8116	.8093	.5436	.4272	.6780	5.1.
PM	.7762	.6011	.2429	.4490	.7335	.7867	.8044	.6238	.7265	.8012	.8022	.8116	5.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1129	.1332	.0181	5.3.
PM	.0331	.0975	.1230	.0211	.0379	.0043	.0006	.1332	.0676	.0105	.0094	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0146	.1174	.0012	5.4.
PM	0.0000	.0603	.1278	.0636	.0109	.0206	.0043	.0547	.0175	0.0000	0.0000	0.0000	5.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.1382	.1315	.1120	5.5.
PM	0.0000	.0505	.3157	.2756	.0293	0.0000	.0023	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0022	0.0000	0.0000	.0022	6.1.
PM	.0022	0.0000	0.0000	.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0022	0.0000	0.0000	6.3.
PM	0.0000	0.0000	.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0022	0.0000	6.5.
PM	0.0000	.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE C-16. FRACTION OF LOS ANGELES POPULATION IN EACH N/M TYPE FOR SUNDAYS

CITY IS LOS ANGELE DAY IS SUN POPULATION IS 7719108.

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	.1884	.1854	.1884	.1848	.1884	.1884	.1884	.1793	.1718	.1360	.1482	.1576	1.1.
PM	.1839	.1588	.1060	.0848	.1259	.1751	.1768	.1862	.1832	.1884	.1884	.1884	1.1.
AM	0.0000	0.0000	0.0000	.0030	0.0000	0.0000	0.0000	.0090	.0158	.0463	.0309	.0224	1.3.
PM	.0044	.0083	.0021	.0003	.0109	0.0000	.0020	.0022	.0052	0.0000	0.0000	0.0000	1.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0068	.0027	1.4.
PM	0.0000	.0041	.0052	.0098	.0042	.0124	.0096	0.0000	0.0000	0.0000	0.0000	0.0000	1.4.
AM	0.0000	.0030	0.0000	.0005	0.0000	0.0000	0.0000	0.0000	.0008	.0060	.0024	.0057	1.5.
PM	0.0000	.0172	.0745	.0928	.0469	.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
PM	0.0000	0.0000	0.0000	0.0000	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
PM	0.0000	0.0000	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
PM	0.0000	0.0000	0.0000	.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.5.
AM	.8116	.7977	.8116	.7962	.8116	.8116	.8116	.7572	.7361	.5780	.6587	.6808	5.1.
PM	.7932	.6925	.4645	.3527	.5078	.7714	.7682	.8015	.7913	.8116	.8116	.8116	5.1.
AM	0.0000	0.0000	0.0000	.0140	0.0000	0.0000	0.0000	.0545	.0730	.2165	.1189	.0935	5.3.
PM	.0184	.0325	.0103	.0017	.0495	0.0000	.0073	.0102	.0203	0.0000	0.0000	0.0000	5.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0194	.0160	5.4.
PM	0.0000	.0156	.0259	.0334	.0193	.0377	.0362	0.0000	0.0000	0.0000	0.0000	0.0000	5.4.
AM	0.0000	.0140	0.0000	.0015	0.0000	0.0000	0.0000	0.0000	.0025	.0171	.0147	.0214	5.5.
PM	0.0000	.0710	.3086	.4215	.2327	.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
PM	0.0000	0.0000	0.0000	0.0000	.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
PM	0.0000	0.0000	.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
PM	0.0000	0.0000	0.0000	.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	6.5.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.1.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.3.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.4.
AM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.
PM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

APPENDIX D

SUPPORTING INFORMATION FOR NATIONAL POPULATION ESTIMATE BY N/M TYPE

TABLE D-1. NATIONAL POPULATION IN EACH N/M TYPE BY HOUR FOR WEEKDAYS

	NATIONAL POPULATION FOR WEEKDAY												
HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	49165015.	49842171.	50323418.	50539298.	50539298.	50539298.	47727538.	38489899.	28359526.	24634137.	19977536.	23179919.	1.1.
PM	29487280.	25524062.	21177257.	24519075.	21088961.	41284854.	48121710.	46604374.	49388607.	49388607.	49388607.	49165015.	1.1.
AM	0.	0.	0.	0.	0.	0.	1856355.	4793257.	2786718.	1684410.	2837901.	711660.	1.3.
PM	0.	322519.	4432423.	1846123.	3200159.	2165134.	344736.	0.	0.	0.	0.	0.	1.3.
AM	0.	0.	0.	0.	0.	0.	0.	589217.	0.	1155657.	0.	111651.	1.4.
PM	965465.	1483189.	2409960.	393660.	192069.	1076578.	921255.	2780744.	0.	0.	0.	0.	1.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	3180132.	7828125.	6635101.	1.5.
PM	192069.	3314698.	2632114.	3895133.	9103583.	2298948.	0.	0.	0.	0.	0.	0.	1.5.
AM	979469.	979469.	0.	0.	0.	0.	0.	0.	16641375.	17082956.	16340410.	17169956.	2.1.
PM	17576006.	16340410.	16870243.	17383921.	18136335.	979469.	979469.	979469.	979469.	979469.	979469.	979469.	2.1.
AM	0.	0.	300966.	0.	0.	0.	0.	0.	0.	300966.	740309.	0.	2.3.
PM	0.	1118753.	0.	0.	0.	3848053.	0.	0.	0.	0.	0.	0.	2.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	116844.	192085.	376207.	192085.	2.4.
PM	0.	116844.	493051.	75241.	116844.	0.	0.	0.	0.	0.	0.	0.	2.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	116844.	212713.	2.5.
PM	0.	0.	212713.	116844.	0.	0.	0.	0.	0.	0.	0.	0.	2.5.
AM	1207567.	302032.	302032.	302032.	302032.	302032.	302032.	7619925.	9399576.	8082861.	7619925.	9249504.	3.1.
PM	9581951.	7804537.	10091603.	8082861.	1370629.	909930.	909930.	909930.	909930.	909930.	909930.	1207567.	3.1.
AM	0.	0.	0.	0.	0.	0.	1166643.	1166643.	1166643.	1166643.	0.	0.	3.3.
PM	1166643.	1166643.	0.	1166643.	3603286.	0.	0.	0.	0.	0.	0.	0.	3.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2664482.	0.	3.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	182375.	1499090.	474616.	1499090.	3.5.
PM	0.	1777414.	656991.	1499090.	1499090.	0.	0.	0.	0.	0.	0.	0.	3.5.
AM	86130233.	87040796.	87776520.	88100906.	88100906.	88100906.	84596185.	70521658.	53444637.	46014177.	37688767.	42429594.	5.1.
PM	55930598.	48813775.	41006425.	46661325.	35052502.	72797977.	83932771.	81940850.	86427597.	86427597.	86427597.	86130233.	5.1.
AM	0.	0.	0.	0.	0.	0.	2416199.	7981672.	5619683.	3032807.	4507532.	1388841.	5.3.
PM	0.	506800.	8064773.	3824733.	6743874.	3180664.	681860.	0.	0.	0.	0.	0.	5.3.
AM	0.	0.	0.	0.	0.	0.	0.	1256062.	0.	1977865.	0.	132075.	5.4.
PM	1646203.	2435232.	4124405.	835274.	423024.	1211980.	1815203.	4496270.	0.	0.	0.	0.	5.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	6972740.	15810465.	14057587.	5.5.
PM	423024.	6244020.	4800733.	6673752.	19296863.	4809671.	0.	0.	0.	0.	0.	0.	5.5.
AM	777768.	777768.	0.	0.	0.	0.	0.	0.	13098951.	13531034.	12858398.	13583600.	6.1.
PM	13948359.	12858398.	13334777.	13778526.	14377363.	777768.	777768.	777768.	777768.	777768.	777768.	777768.	6.1.
AM	0.	0.	239300.	0.	0.	0.	0.	0.	0.	239300.	669147.	0.	6.3.
PM	0.	969645.	0.	0.	0.	3151521.	0.	0.	0.	0.	0.	0.	6.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	108557.	168502.	299246.	168502.	6.4.
PM	0.	108557.	409054.	59039.	108557.	0.	0.	0.	0.	0.	0.	0.	6.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	108557.	195005.	6.5.
PM	0.	0.	195005.	108557.	0.	0.	0.	0.	0.	0.	0.	0.	6.5.
AM	920154.	231590.	231590.	231590.	231590.	231590.	231590.	5895017.	7232337.	6249720.	5895017.	7126017.	7.1.
PM	7379715.	6039253.	7746646.	6249720.	1042014.	687312.	687312.	687312.	687312.	687312.	687312.	920154.	7.1.
AM	0.	0.	0.	0.	0.	0.	866775.	866775.	866775.	866775.	0.	0.	7.3.
PM	866775.	866775.	0.	866775.	2704925.	0.	0.	0.	0.	0.	0.	0.	7.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1985997.	0.	7.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	146473.	1119222.	354703.	1119222.	7.5.
PM	0.	1339557.	499844.	1119222.	1119222.	0.	0.	0.	0.	0.	0.	0.	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE D-2. NATIONAL POPULATION IN EACH N/M TYPE BY HOUR FOR SATURDAYS

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	N/M
					NATIONAL POPULATION FOR SATURDAY								
AM	50762891.	50762891.	50762891.	50762891.	50762891.	50762891.	50762891.	50762891.	50636515.	32643251.	26931016.	43874666.	1.1.
PM	48716610.	38838396.	16605610.	28043915.	45668173.	48534289.	50264431.	40057486.	45272677.	50278777.	50272652.	50762891.	1.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	8945485.	6550341.	919937.	1.3.
PM	1919905.	5831057.	9177135.	1339600.	2340517.	322519.	50471.	7392125.	4331413.	492730.	498855.	0.	1.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	965465.	8200614.	111651.	1.4.
PM	0.	3060970.	7698840.	5083375.	771736.	1914699.	322519.	3312374.	1155657.	0.	0.	0.	1.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	8093168.	8966303.	5730261.	1.5.
PM	0.	2917852.	17154931.	16179148.	1980306.	0.	123233.	0.	0.	0.	0.	0.	1.5.
AM	0.	0.	0.	0.	0.	0.	0.	0.	212713.	0.	0.	212713.	2.1.
PM	212713.	0.	0.	212713.	0.	0.	0.	0.	0.	0.	0.	0.	2.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	212713.	0.	0.	2.3.
PM	0.	0.	212713.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	212713.	0.	2.5.
PM	0.	212713.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.5.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.1.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.3.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.5.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.5.
AM	88407792.	88407792.	88407792.	88407792.	88407792.	88407792.	88407792.	88407792.	88124292.	58163038.	46423597.	74868080.	5.1.
PM	84649787.	65908530.	27409709.	49184636.	80131642.	85540909.	87535920.	67918181.	78486053.	87358762.	87312225.	88407792.	5.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	13246805.	13503738.	1754421.	5.3.
PM	3477994.	10888320.	13559402.	2186378.	3964874.	506800.	83810.	14239118.	7937841.	1052174.	1086045.	0.	5.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	1646203.	13540123.	132075.	5.4.
PM	0.	6039525.	14205879.	7086390.	1282304.	2360084.	506800.	6241877.	1977865.	0.	0.	0.	5.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	15058724.	14656834.	11358942.	5.5.
PM	0.	5292312.	32933401.	29656115.	3022939.	0.	283500.	0.	0.	0.	0.	0.	5.5.
AM	0.	0.	0.	0.	0.	0.	0.	0.	195005.	0.	0.	195005.	6.1.
PM	195005.	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	6.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	195005.	0.	0.	6.3.
PM	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	195005.	0.	6.5.
PM	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.5.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.1.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.3.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.5.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE D-3. NATIONAL POPULATION IN EACH N/M TYPE BY HOUR FOR SUNDAYS

HOUR	NATIONAL POPULATION FOR SUNDAY												
	1	2	3	4	5	6	7	8	9	10	11	12	N/M
AM	50762891.	50051231.	50762891.	49952665.	50762891.	50762891.	50762891.	48226963.	46009287.	37631430.	39162077.	42750934.	1.1.
PM	49528480.	43056572.	28001995.	23054690.	33947559.	47648495.	47837204.	49923945.	48874605.	50762891.	50762891.	50762891.	1.1.
AM	0.	0.	0.	711660.	0.	0.	0.	2544544.	4545994.	11960969.	9596530.	6003910.	1.3.
PM	1233505.	1877119.	558274.	127454.	2665200.	0.	344736.	848468.	1896556.	0.	0.	0.	1.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1318579.	750850.	1.4.
PM	0.	909768.	1948858.	2211556.	1667540.	2905880.	2592709.	0.	0.	0.	0.	0.	1.4.
AM	0.	711660.	0.	99897.	0.	0.	0.	0.	215880.	1179108.	684799.	1266719.	1.5.
PM	0.	4927702.	20129626.	25244146.	12357123.	215880.	0.	0.	0.	0.	0.	0.	1.5.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.1.
PM	0.	0.	0.	0.	212713.	0.	0.	0.	0.	0.	0.	0.	2.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.3.
PM	0.	0.	212713.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2.5.
PM	0.	0.	0.	212713.	0.	0.	0.	0.	0.	0.	0.	0.	2.5.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.1.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.3.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.5.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	3.5.
AM	88407792.	87022095.	88407792.	86849931.	88407792.	88407792.	88407792.	82960096.	79724453.	64212147.	71166586.	73674486.	5.1.
PM	86289950.	76084708.	49747229.	39830130.	56589001.	83563766.	83562230.	87304037.	86246927.	88407792.	88407792.	88407792.	5.1.
AM	0.	0.	0.	1388841.	0.	0.	0.	5440332.	8349431.	22215534.	13594792.	11051635.	5.3.
PM	2108320.	3402922.	1187820.	201394.	5035675.	0.	681860.	1104662.	2160866.	0.	0.	0.	5.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	2183882.	1623694.	5.4.
PM	0.	1636635.	3015682.	3819036.	2044025.	4507881.	4164608.	0.	0.	0.	0.	0.	5.4.
AM	0.	1388841.	0.	160404.	0.	0.	0.	0.	324386.	1980111.	1463439.	2060135.	5.5.
PM	0.	7274005.	34173561.	44273732.	24448306.	324386.	0.	0.	0.	0.	0.	0.	5.5.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.1.
PM	0.	0.	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	6.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.3.
PM	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	6.5.
PM	0.	0.	0.	195005.	0.	0.	0.	0.	0.	0.	0.	0.	6.5.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.1.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.1.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.3.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.3.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.4.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.4.
AM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.5.
PM	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	7.5.

N = 1 = CENTER CITY RESIDENTIAL
2 = CENTER CITY COMMERCIAL
3 = CENTER CITY INDUSTRIAL

N = 5 = SUBURBAN RESIDENTIAL
6 = SUBURBAN COMMERCIAL
7 = SUBURBAN INDUSTRIAL

M = 1 = INDOORS
3 = VEHICLE
4 = ROADSIDE

M = 5 = OUTDOORS

TABLE D-4. MOBILE SOURCE MICROENVIRONMENT PERSON HOURS SUBTRACTED FROM NEM N/M TYPES

Weekdays

Hour Ending	Urban Core							
	Residential			Commercial			Industrial	
	Indoor	Vehicle	Roadside	Indoor	Vehicle	Roadside	Indoor	Vehicle
1 AM				201,750			2,240	
2 AM				120,513			1,434	
3 AM					70,339		896	
4 AM	69,906						571	
5 AM	85,888						605	
6 AM	217,023						1,568	
7 AM		562,793						4,446
8 AM		1,499,125						6,843
9 AM		48,517		154,452	1,806,402	116,844		6,675
10 AM		73,418		1,467,303	300,966	192,085		5,914
11 AM		80,635		959,846	740,309	376,207	5,656	
Noon		66,126		2,244,574		192,085	5,611	
1 PM	65,332			3,553,017				5,533
2 PM		68,733		2,082,723	1,118,753	116,844		5,578
3 PM		63,405		2,272,966		493,051	6,115	
4 PM		71,869		2,451,824		75,241		7,056
5 PM		74,061		2,795,977		116,844		7,706
6 PM		69,375			2,854,616		7,101	
7 PM	168,409	344,736	474,112	600,156			6,709	
8 PM	354,636		323,311	425,886			6,451	
9 PM	386,177			477,700			5,163	
10 PM	319,933			357,069			4,670	
11 PM	16,966			509,813			4,200	
Midnight	9,484			389,195			3,349	

TABLE D-4 (Cont'd). MOBILE SOURCE MICROENVIRONMENT PERSON HOURS SUBTRACTED FROM NEM N/M TYPES

Weekdays

Hour Ending	Suburban					
	Residential		Commercial		Industrial	
	Indoor	Vehicle	Indoor	Vehicle	Indoor	Vehicle
1 AM			747		1,493	
2 AM			478		956	
3 AM				299	597	
4 AM	190				381	
5 AM	202				403	
6 AM	523				1,045	
7 AM		5,223				2,964
8 AM		28,466				4,562
9 AM		12,129	38,638			4,450
10 AM		18,355	55,064	1,971		3,942
11 AM		20,159	60,477	1,885	3,771	
Noon		16,531	51,464		3,741	
1 PM	16,333		50,843			3,688
2 PM		17,183		53,409		3,718
3 PM		15,851	49,592		4,077	
4 PM		17,967	56,254			4,704
5 PM		18,515	58,114			5,137
6 PM		17,344	54,398	52,031	4,734	
7 PM		9,758	31,511		4,472	
8 PM	7,831		25,708		4,301	
9 PM	6,830		22,210		3,442	
10 PM	3,864		13,148		3,114	
11 PM	4,242		14,125		2,800	
Midnight	2,371		8,229		2,232	

TABLE D-5. MOBILE SOURCE MICROENVIRONMENT PERSON HOURS SUBTRACTED FROM NEM N/M TYPES

Saturday

Hour	Urban Core						Suburban	
	Residential			Commercial			Residential	
Ending	Indoor	Vehicle	Roadside	Indoor	Vehicle	Roadside	Indoor	Vehicle
1 AM	746,322						14,833	
2 AM	637,226						10,158	
3 AM	520,025						6,878	
4 AM	331,460						4,045	
5 AM	240,782						3,865	
6 AM	267,476						3,282	
7 AM	401,228						17,456	
8 AM	559,908						26,925	
9 AM	435,014			212,713			354,398	
10 AM	638,104				212,713		531,778	
11 AM	1,493,215						1,137,953	
Noon	1,390,229			212,713			2,248,315	
1 PM	1,633,334			212,713			1,315,245	
2 PM	1,962,460						1,576,756	
3 PM	1,947,016				212,713		1,595,529	
4 PM	1,754,845			212,713			1,490,191	
5 PM	1,753,362						1,496,094	
6 PM	1,345,165						1,225,140	
7 PM	990,451						989,404	
8 PM	841,867						888,913	
9 PM	780,664						810,074	
10 PM	719,068						681,566	
11 PM	688,903						557,714	
Midnight	920,732						19,058	

TABLE D-6 MOBILE SOURCE MICROENVIRONMENT PERSON HOURS SUBTRACTED FROM NEM N/M TYPES

Sunday

Hour Ending	Urban Core						Suburban	
	Residential			Commercial			Residential	
	Indoor	Vehicle	Roadside	Indoor	Vehicle	Roadside	Indoor	Vehicle
1 AM	633,746							
2 AM	536,369						9,603	
3 AM	438,139						6,577	
4 AM	291,254						4,453	
5 AM	200,254						2,619	
6 AM	170,659						2,503	
7 AM	207,652						2,125	
8 AM	268,590						5,675	
9 AM	238,484						36,151	
10 AM	317,251						224,712	
11 AM	431,152						297,682	
Noon	566,664						374,883	
1 PM	659,056						467,699	
2 PM	727,061						528,878	
3 PM	657,073				212,713		574,340	
4 PM	728,538						527,411	
5 PM	695,716						576,734	
6 PM	553,877						534,896	
7 PM	437,769						400,292	
8 PM	384,129						303,965	
9 PM	364,860						269,285	
10 PM	336,066						254,923	
11 PM	321,912						234,374	
Midnight	267,531						224,087	
							187,168	

APPENDIX E

LISTING OF MOBEX COMPUTER PROGRAM

```
      PROGRAM MOBEX(INPUT,OUTPUT )
      DIMENSION XNDY(3),ITITLE(4) ,XMULT(4),SUM(25,32,3),FRAC(25),
     1          IEMISS(2),XNEF(8,3),XMSEMF(4,3),CONEXC(25),GRSUM(25),
     2           X(25),Y(25),TEMP(26)
      COMMON /TOTPOP/ P(32,24,3) /CONC/CONVAL(25,32,3)
      DATA  XMULT/ 0.85,2.10,1.20,0.95/,XNDY/ 248.,62.,55./
 1000 FORMAT(4A10, A10,A6)
 2000 FORMAT(1H1,/////,21X,4A10,/,24X,*POLLUTANT: *,A10,A6,///,
     1       17X,*EXPOSURE TO*,15X,*PERSON*,/,
     2       17X,*CONCENTRATIONS*,12X,*HOURS*,/,
     3       17X,*EXCEEDING*,     17X,*EXPOSURE*,/,
     4       17X,*(MICROGRAM/CU.M)*11X,*(MILLIONS) *,/,
     5       17X,*-----------------*11X,*------------*)
 2010 FORMAT(1H ,22X,F10.3,11X,F11.3)
C
C***** READ INPUT VALUES
C
      READ 1000,  ITITLE, IEMISS
      READ *, YURPOP, YRURPO, CONINV
      DO 50  JDAY=1,3
   50 READ *, (XNEF(N,JDAY),N=1,6),(XMSEMF(M,JDAY),M=1,4),XNEF(8,JDAY)
      IF(CONINV.LT.1.0) GO TO 60
      READ *,(CONEXC(I),I=1,25)
   60 CONTINUE
C
C***** CALCULATE POPULATION MULTIPLIER FOR YEAR OTHER THAN 1980
C
      IF(YURPOP.EQ.0.) YURPOP=139170683.
      POPMLT =  YURPOP/139170683.
      IF(YRURPO.EQ.0.) YRURPO = 87334142
C
C***** BEGIN CALCULATION LOOP
C
      INM= 0
      DO  500     N= 1,8
      IF(N.EQ.8)  POPMLT =  YRURPO/87334142
      DO  500     M= 1,4

      INM= INM+1
      DO  500  JDAY= 1,3
      DO 200 KCON=1,25
      SUM(KCON,INM,JDAY)=0
  200 CONTINUE
      DO  300  KHR = 1,24
      CALL CHOPOL(N,M,JDAY,KHR,FRAC)
      DO 250 KCON=1,26
      TEMP(KCON)=0
  250 CONTINUE
      DO  300  KCON = 1,25
      TEMP(26-KCON)= TEMP(27-KCON)
     1     +(FRAC(26-KCON)*POPMLT*(P(INM,KHR,JDAY)/1.0E6)* XNDY(JDAY))
      SUM((26-KCON),INM,JDAY)=TEMP(26-KCON) + SUM((26-KCON),INM,JDAY)
  300 CONTINUE
C
C***** DETERMINE CONCENTRATION INTERVALS FOR EACH N/M ,EACH DAY
C
      IF(N.NE.7) EMSFAC=XNEF(N,JDAY)
      IF(N.NE.7) XM =XMULT(M)
      IF(N.EQ.7) EMSFAC = XMSEMF(M,JDAY)
      IF(N.EQ.7) XM=1.0
      LLL=N*4
      IF(N.EQ.7)LLL=INM
      DO 500 I=1,25
      CONVAL(I,INM,JDAY) = CONVAL(I,LLL,JDAY) * XM      * EMSFAC
  500 CONTINUE
C
C***** DETERMINE SET OF COMMON INTERVALS
C      IF INTERVALS NOT INPUT,THEY ARE DETERMINED IN CALCIN
C
      IF(CONINV.EQ.0 ) CALL CALCIN(CONVAL,CONEXC)
C
C***** INTERPOLATE TO GET NEW CUMCULATIVE PERSON HOURS AT
C       THE COMMON INTERVAL BOUNDRIES
C
      DO 600 JDAY=1,3
      DO 600 INM= 1,32
      DO 550 J=1,25
      X(J)=CONVAL(J,INM,JDAY)
      Y(J)= SUM(J,INM,JDAY)
  550 CONTINUE
      DO 600 I= 1,25
      IF(CONEXC(I).GT.X(25)) GO TO 575
      SUM(I,INM,JDAY)  = FLAGR(X,Y,CONEXC(I),2,1,25)
      IF(SUM(I,INM,JDAY).LT.0) SUM(I,INM,JDAY)= 0.
      GO TO 600
  575 SUM(I,INM,JDAY)= 0.0
  600 CONTINUE
      CALL PMDARRY(25,4,1)
      CALL PMDLOAD
C
C***** PRINT TITLE
C
      PRINT 2000, ITITLE, IEMISS
C
C***** SUM CUM. PERSON HOURS AT EACH INTERVAL BOUND FOR ALL
C       N/M AND DAY TYPES
C
      DO 750  KCON= 1,25
      GRSUM(KCON)=SUM(KCON,1,1)+SUM(KCON,1,2)+SUM(KCON,1,3)
      DO 700  INM= 2,32
      GRSUM(KCON)=GRSUM(KCON)+SUM(KCON,INM,1)+SUM(KCON,INM,2)+
     1             SUM(KCON,INM,3)
  700 CONTINUE
      PRINT 2010,   CONEXC(KCON), GRSUM(KCON)
  750 CONTINUE
      STOP
      END
      SUBROUTINE CHOPOL(N,M,JDAY,KHR,FRAC)
      DIMENSION FRAC(25)
      COMMON/PLFRC1/ POLFR1(25,6,3),POLFR2(25,6,3),POLFR3(25,6,3),
     1               POLFR4(25,6,3),POLFR5(25,6,3),POLFR6(25,6,3)/
     2       PLFRC2/  POLFRS(25,6,3),POLFRT(25,7,3),POLFRP(25,2,3)/
     3        PLFRC3/ POLFRR(25,6,3)
      GO TO(110,120,130,140,150,160,500,170) N
  110 GO TO (111,112,113) JDAY
  111 CONTINUE
      GO TO (201,201,201,201,201,202,203,203,203,203,204,204,
     1       204,204,204,205,205,205,206,206,206,206,206,206) KHR
  112 CONTINUE
      GO TO (201,201,202,202,202,202,203,203,203,204,204,204,
     1       205,205,205,205,205,205,206,206,206,206,206,206) KHR
  113 CONTINUE
      GO TO (201,201,202,202,203,203,204,204,204,205,205,205,
     1       205,205,205,205,205,206,206,206,206,206,206,206) KHR
  120 GO TO (121,122,123) JDAY
  121 CONTINUE
      GO TO (201,201,201,201,201,202,203,203,203,203,204,204,
     1       204,204,205,205,205,205,206,206,206,206,206,206) KHR
  122 CONTINUE
      GO TO (201,202,202,202,202,202,203,204,204,204,204,204,
     1       204,204,205,205,205,205,206,206,206,206,206,206) KHR
  123 CONTINUE
      GO TO (201,201,202,202,202,202,202,203,203,203,203,203,
     1       204,204,204,204,204,205,205,205,205,205,206,206) KHR
  130 GO TO (131,132,133) JDAY
  131 CONTINUE
      GO TO (201,201,201,201,201,201,202,203,203,204,204,204,
     1       204,204,204,204,205,205,206,206,206,206,206,206) KHR
  132 CONTINUE
      GO TO (201,202,202,202,203,203,204,204,204,204,204,204,
     1       204,204,205,205,205,206,206,206,206,206,206,206) KHR
  133 CONTINUE
      GO TO (201,201,201,202,202,202,202,202,203,203,203,203,
     1       204,204,204,204,204,204,205,205,206,206,206,206) KHR
  140 GO TO (141,142,143) JDAY
  141 CONTINUE
      GO TO (201,201,201,201,201,202,203,203,203,203,204,204,
     1       204,204,204,204,205,205,206,206,206,206,206,206) KHR
  142 CONTINUE
      GO TO (201,201,202,202,202,202,203,203,203,203,203,203,
     1       204,204,204,204,204,205,206,206,206,206,206,206) KHR
  143 CONTINUE
      GO TO (201,201,202,202,203,203,203,203,203,204,204,204,
     1       204,204,204,204,204,205,206,206,206,206,206,206) KHR
  150 GO TO (151,152,153) JDAY
  151 CONTINUE

      GO TO (201,202,202,202,202,203,204,204,204,204,205,205,
     1       205,205,205,206,206,206,206,206,206,206,206,206) KHR
  152 CONTINUE
      GO TO (201,201,201,202,202,202,203,204,204,204,204,204,
     1       204,204,205,205,205,205,206,206,206,206,206,206) KHR
  153 CONTINUE
      GO TO (201,201,201,201,202,202,203,204,204,204,204,204,
     1        205,205,205,205,205,206,206,206,206,206,206,206) KHR
  160 GO TO (161,162,163) JDAY
  161 CONTINUE
      GO TO (201,202,202,202,202,202,203,204,204,204,205,205,
     1        205,205,205,205,206,206,206,206,206,206,206,206) KHR
  162 CONTINUE
      GO TO (201,201,201,201,202,202,203,203,203,203,203,204,
     1        204,205,205,205,205,205,206,206,206,206,206,206) KHR
  163 CONTINUE
      GO TO (201,201,202,202,202,202,202,203,203,203,203,203,
     1        204,204,204,204,204,205,205,206,206,206,206,206) KHR
  170 GO TO (171,172,173) JDAY
  171 CONTINUE
      GO TO (201,201,201,201,201,201,201,201,201,201,201,201,
     1        201,201,201,201,201,201,201,201,201,201,201,201) KHR
  172 CONTINUE
      GO TO (201,201,201,201,201,201,201,201,201,201,201,201,
     1        201,201,201,201,201,201,201,201,201,201,201,201) KHR
  173 CONTINUE
      GO TO (201,201,201,201,201,201,201,201,201,201,201,201,
     1        201,201,201,201,201,201,201,201,201,201,201,201) KHR
  201 L=1
      GO TO 210
  202  =2
      GO TO 210
  203 L=3
      GO TO 210
  204 L=4
      GO TO 210
  205 L=5
      GO TO 210
  206 L=6
      GO TO 210
  210 CONTINUE
      DO 250  KCON=1,25
      IF(N.EQ.1) FRAC(KCON) = POLFR1(KCON,L,JDAY)
      IF(N.EQ.2) FRAC(KCON) = POLFR2(KCON,L,JDAY)
      IF(N.EQ.3) FRAC(KCON) = POLFR3(KCON,L,JDAY)
      IF(N.EQ.4) FRAC(KCON) = POLFR4(KCON,L,JDAY)
      IF(N.EQ.5) FRAC(KCON) = POLFR5(KCON,L,JDAY)
      IF(N.EQ.6) FRAC(KCON) = POLFR6(KCON,L,JDAY)
      IF(N.EQ.8) FRAC(KCON) = POLFR8(KCON,L,JDAY)
  250 CONTINUE
      GO TO 900
  500 CONTINUE
      GO TO (510,520,530,540) M
  510 GO TO (511,512,513) JDAY
  511 CONTINUE
      GO TO (601,601,601,601,601,601,602,603,603,604,604,604,
     1        604,604,604,605,605,605,606,606,606,606,606,606) KHR
  512 CONTINUE
      GO TO (601,601,601,602,602,602,603,603,604,604,604,604,
     1        605,605,605,605,605,605,606,606,606,606,606,606) KHR
  513 CONTINUE
      GO TO (601,601,602,602,603,603,603,603,603,603,604,604,
     1        604,604,605,605,605,605,605,605,605,605,605,606) KHR
  520 GO TO (521,522,523) JDAY
```

```
      521 CONTINUE
          GO TO (603,602,601,601,602,604,607,606,606,606,606,606,
     1           605,605,606,607,607,607,606,606,605,605,604,603) KHR
      522 CONTINUE
          GO TO (604,603,602,601,601,601,602,604,604,605,605,606,
     1           606,606,606,607,607,606,606,607,606,605,605,605) KHR
      523 CONTINUE
          GO TO (604,603,602,601,601,601,602,604,604,605,605,606,
     1           606,606,606,607,607,606,606,607,606,605,605,605) KHR
      530 GO TO (531,532,533) JDAY
      531 CONTINUE
          GO TO (601,601,601,601,601,601,601,602,601,601,601,601,
     1           601,601,601,601,601,602,601,601,601,601,601,601) KHR
      532 CONTINUE
          GO TO (601,601,601,601,601,601,601,601,601,601,601,601,
     1           601,601,601,601,601,601,601,601,601,601,602,601) KHR
      533 CONTINUE
          GO TO (601,601,601,601,601,601,601,601,601,601,601,601,
     1           601,601,601,601,601,601,601,601,601,601,601,601) KHR
      540 CONTINUE
          GO TO 601
      601 L=1
          GO TO 610
      602 L=2
          GO TO 610
      603 L=3
          GO TO 610
      604 L=4
          GO TO 610
      605 L=5
          GO TO 610
      606 L=6
          GO TO 610
      607 L=7
          GO TO 610
      610 CONTINUE
          DO 650 KCON=1,25
          IF(M.EQ.1)FRAC(KCON)=POLFRS(KCON,L,JDAY)
          IF(M.EQ.2)FRAC(KCON)=POLFRT(KCON,L,JDAY)
          IF(M.EQ.3)FRAC(KCON)=POLFRP(KCON,L,JDAY)
          IF(M.EQ.4)FRAC(KCON)=POLFRS(KCON,L,JDAY)
      650 CONTINUE
      900 RETURN
          END
      SUBROUTINE CALCIN( CONVAL, CONEXC)
      DIMENSION  CONVAL(25,32,3), CONEXC(25)
      MAX = 0.0
      DO 100 JDAY=1,3
      DO 100  INM = 1,32
  100 IF(CONVAL(25,INM,JDAY).GT.MAX) MAX = CONVAL(25,INM,JDAY)
      IF(MAX.GT.1) GO TO 200
      IF(MAX.GT.0.0001) II=-4
      IF(MAX.GT.0.001)  II=-3
      IF(MAX.GT.0.01)   II=-2
      IF(MAX.GT.0.1)    II=-1
      GO TO 500
  200 CONTINUE
      II=0
      IF(MAX.GT.10) II=1
      IF(MAX.GT.100) II=2
      IF(MAX.GT.1000) II=3
      IF(MAX.GT.10000) II=4
      IF(MAX.GT.100000) II=5
  500 IMAX =  MAX/(10**II)
      IF(IMAX.EQ.10) GO TO 510 .
      IMAX= IMAX+1
  510 IMAX= IMAX * (10**II)
      SCALE =  IMAX/200
      CONEXC(1)=0
      CONEXC(2) = SCALE
      DO 600 J=3,25
      XMULT= 1.0
      IF(J.GT.5) XMULT= 3.0
      IF(J.GT.14) XMULT= 6.0
      IF(J.GT.16) XMULT=12.0
      IF(J.GT.17) XMULT=16.0
      IF(J.GT.21) XMULT=20.0
      CONEXC(J) = CONEXC(J-1) + (XMULT * SCALE)
  600 CONTINUE
      RETURN
      END
```

```
FUNCTION FLAGR      73/74   OPT=1  PMDMP                     FTN 4.8+552        84/07/09. 16.17.07        PAGE     1

      FUNCTION FLAGR ( X,Y,XARG,IDEG,MIN,N )
C
C      FLAGR USES THE LAGRANGE FORMULA TO EVALUATE THE INTERPOLATING
C      POLYNOMIAL OF DEGREE IDEG FOR ARGUMENT XARG USING THE DATA
C      VALUES X(MIN)...X(MAX) AND Y(MIN)...Y(MAX) WHERE
C      MAX = MIN + IDEG.  X(I) IS ASSUMED TO BE IN ASCENDING
C      ORDER, AND SUBSCRIPT CHECKING IS PERFORMED.  TERM IS
C      A VARIABLE WHICH CONTAINS SUCCESSIVELY EACH TERM OF THE
C      LAGRANGE FORMULA.  THE FINAL VALUE OF YEST IS THE INTERPOLATED
C      VALUE.  SEE CARNAHAN ET AL,APPL.NUM.METH.,WILEY,1969,P.29.
C
      DIMENSION X(1), Y(1)
C
C     ..... LOCATE AN X-VALUE NEAR XARG .....
      DO 20 I=1,N
      IF (X(I) .LT. XARG)  GO TO 20
      MIN = I - IDEG/2
      MAX = MIN + IDEG
      GO TO 30
   20 CONTINUE
C
C     ..... CHECK SUBSCRIPT BOUNDS .....
   30 CONTINUE
      IF (MIN .GT. 0)  GO TO 40
      MIN = 1
      MAX = MIN + IDEG
      GO TO 50
   40 CONTINUE
      IF (MAX .LE. N)  GO TO 50
      MAX = N
      MIN = MAX - IDEG
   50 CONTINUE
C
C     ..... COMPUTE VALUE OF FACTOR .....
      FACTOR = 1.0
      DO 60  J=MIN,MAX
      IF (XARG .NE. X(J))  GO TO 60
      FLAGR = Y(J)
      RETURN
   60 FACTOR = FACTOR*(XARG - X(J))
C
C     ..... EVALUATE INTERPOLATING POLYNOMIAL .....
      YEST = 0.0
      DO 80  I=MIN,MAX
      TERM = Y(I)*FACTOR/(XARG - X(I))
      DO 70  J=MIN,MAX
      IF (I .NE. J)  TERM = TERM/(X(I) - X(J))
   70 CONTINUE
      YEST = YEST + TERM
   80 CONTINUE
      FLAGR = YEST
      RETURN
      END
      C
             BLOCK DATA MOBCON
             COMMON/PLFRC2/POLFRS(25,6,3),POLFRT(25,7,3),POLFRP(25,2,3)
      C***   ORDER OF DATA IS  WEEKDAYS BY HOUR GROUP THEN SAT. AND SUN.
             DATA((POLFRS(I,J,1),J=1,6),I=1,13)/
            A          .3358,  .0621,  .0191,  .0223,  .0182,  .0923,              WKD
            B          .4051,  .2858,  .1137,  .1292,  .1005,  .2954,              WKD
            C          .1435,  .2568,  .1862,  .1988,  .1616,  .2537,              WKD
            D          .0631,  .1750,  .1818,  .1800,  .1673,  .1550,              WKD
            E          .0271,  .1000,  .1505,  .1427,  .1421,  .0885,              WKD
            F          .0130,  .0541,  .1049,  .1039,  .1133,  .0477,              WKD
            G          .0060,  .0300,  .0811,  .0757,  .0934,  .0275,              WKD
            H          .0034,  .0139,  .0603,  .0549,  .0675,  .0166,              WKD
            I          .0015,  .0098,  .0326,  .0350,  .0470,  .0095,              WKD
            J          .0007,  .0057,  .0239,  .0236,  .0324,  .0056,              WKD
            K          .0004,  .0035,  .0163,  .0142,  .0216,  .0026,              WKD
            L          .0002,  .0010,  .0104,  .0076,  .0128,  .0018,              WKD
            M          .0002,  .0012,  .0066,  .0051,  .0084,  .0010/              WKD
             DATA ((POLFRS(I,J,1),J=1,6),I=14,25)/
            N          .0000,  .0004,  .0035,  .0032,  .0053,  .0009,              WKD
            O          .0000,  .0004,  .0045,  .0029,  .0050,  .0012,              WKD
            P          .0000,  .0002,  .0030,  .0009,  .0024,  .0004,              WKD
            O          .0000,  .0000,  .0007,  .0001,  .0009,  .0002,              WKD
            R          .0000,  .0000,  .0003,  .0000,  .0001,  .0000,              WKD
            S          .0000,  .0000,  .0002,  .0000,  .0000,  .0000,              WKD
            T          .0000,  .0000,  .0001,  .0000,  .0000,  .0000,              WKD
            U          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              WKD
            V          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              WKD
            W          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              WKD
            X          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              WKD
            Y          .0000,  .0000,  .0000,  .0000,  .0000,  .0000/              WKD
             DATA((POLFRS(I,J,2),J=1,6),I=1 ,13)/
            A          .1987,  .3137,  .1647,  .0839,  .0613,  .0992,              SAT
            B          .3246,  .4096,  .4222,  .3320,  .2998,  .3070,              SAT
            C          .1946,  .1604,  .2339,  .2734,  .2622,  .2311,              SAT
            D          .1162,  .0618,  .1079,  .1564,  .1569,  .1572,              SAT
            E          .0650,  .0331,  .0457,  .0829,  .0947,  .0955,              SAT
            F          .0372,  .0114,  .0141,  .0424,  .0548,  .0462,              SAT
            G          .0261,  .0057,  .0070,  .0149,  .0325,  .0238,              SAT
            H          .0168,  .0030,  .0030,  .0078,  .0167,  .0157,              SAT
            I          .0101,  .0007,  .0010,  .0038,  .0098,  .0116,              SAT
            J          .0050,  .0007,  .0005,  .0015,  .0056,  .0062,              SAT
            K          .0034,  .0000,  .0000,  .0003,  .0027,  .0034,              SAT
            L          .0013,  .0000,  .0000,  .0003,  .0010,  .0019,              SAT
            M          .0007,  .0000,  .0000,  .0003,  .0008,  .0005/              SAT
             DATA((POLFRS(I,J,2),J=1,6),I=14,25)/                                  SAT
            N          .0003,  .0000,  .0000,  .0000,  .0005,  .0002,              SAT
            O          .0000,  .0000,  .0000,  .0000,  .0002,  .0002,              SAT
            P          .0000,  .0000,  .0000,  .0000,  .0005,  .0005,              SAT
            O          .0000,  .0000,  .0000,  .0003,  .0000,  .0000,              SAT
            R          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              SAT
            S          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              SAT
            T          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              SAT
            U          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              SAT
            V          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              SAT
            W          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              SAT
            X          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,              SAT
```

```
     Y          .0000,  .0000,  .0000,  .0000,  .0000,  .0000/               SAT
      DATA((POLFRS(I,J,3),J=1,6),I=1,13)/
     A          .1851,  .2718,  .2873,  .1847,  .1484,  .2064,               SUN
     B          .3190,  .3885,  .4847,  .4672,  .3946,  .4087,               SUN
     C          .2031,  .1618,  .1509,  .1976,  .2186,  .1815,               SUN
     D          .1149,  .0830,  .0489,  .0930,  .1160,  .1120,               SUN
     E          .0764,  .0384,  .0143,  .0299,  .0574,  .0477,               SUN
     F          .0308,  .0197,  .0091,  .0167,  .0296,  .0249,               SUN
     G          .0338,  .0166,  .0017,  .0048,  .0154,  .0073,               SUN
     H          .0144,  .0093,  .0012,  .0025,  .0089,  .0062,               SUN
     I          .0108,  .0041,  .0005,  .0020,  .0043,  .0010,               SUN
     J          .0041,  .0031,  .0003,  .0010,  .0028,  .0021,               SUN
     K          .0015,  .0000,  .0003,  .0005,  .0026,  .0010,               SUN
     L          .0021,  .0016,  .0002,  .0000,  .0011,  .0010,               SUN
     M          .0021,  .0000,  .0005,  .0000,  .0001,  .0000/               SUN
      DATA((POLFRS(I,J,3),J=1,6),I=14,25)/                                   SAT
     N          .0000,  .0010,  .0000,  .0000,  .0002,  .0000,               SUN
     O          .0005,  .0010,  .0002,  .0000,  .0000,  .0000,               SUN
     P          .0010,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     O          .0005,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     R          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     S          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     T          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     U          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     V          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     W          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     X          .0000,  .0000,  .0000,  .0000,  .0000,  .0000,               SUN
     Y          .0000,  .0000,  .0000,  .0000,  .0000,  .0000/               SUN
C***  ORDER OF DATA IS  WEEKDAYS BY ADT FROM 0.5 PCT TO 6.5 PCT
      DATA((POLFRT(I,J,1),J=1,7),I=1,13)/
     A   .777  ,  .288  ,  .067  ,  .013  ,  .006  ,  .001  ,  .000  ,       WKD
     B   .129  ,  .317  ,  .230  ,  .109  ,  .045  ,  .018  ,  .007  ,       WKD
     C   .044  ,  .169  ,  .218  ,  .175  ,  .105  ,  .057  ,  .030  ,       WKD
     D   .011  ,  .052  ,  .086  ,  .088  ,  .068  ,  .045  ,  .027  ,       WKD
     E   .008  ,  .038  ,  .071  ,  .081  ,  .071  ,  .052  ,  .035  ,       WKD
     F   .006  ,  .029  ,  .058  ,  .073  ,  .071  ,  .057  ,  .042  ,       WKD
     G   .004  ,  .022  ,  .047  ,  .065  ,  .068  ,  .059  ,  .047  ,       WKD
     H   .006  ,  .030  ,  .069  ,  .105  ,  .120  ,  .116  ,  .100  ,       WKD
     I   .004  ,  .019  ,  .046  ,  .077  ,  .099  ,  .107  ,  .102  ,       WKD
     J   .003  ,  .012  ,  .032  ,  .056  ,  .078  ,  .092  ,  .095  ,       WKD
     K   .002  ,  .008  ,  .022  ,  .041  ,  .061  ,  .077  ,  .085  ,       WKD
     L   .001  ,  .005  ,  .015  ,  .030  ,  .047  ,  .063  ,  .074  ,       WKD
     M   .001  ,  .004  ,  .011  ,  .022  ,  .036  ,  .051  ,  .062  /       WKD
      DATA((POLFRT(I,J,1),J=1,7),I=14,25)/
     N   .001  ,  .003  ,  .008  ,  .016  ,  .028  ,  .041  ,  .052  ,       WKD
     O   .001  ,  .002  ,  .006  ,  .012  ,  .021  ,  .033  ,  .043  ,       WKD
     P   .001  ,  .003  ,  .007  ,  .016  ,  .029  ,  .047  ,  .065  ,       WKD
     O   .001  ,  .003  ,  .008  ,  .019  ,  .033  ,  .057  ,  .085  ,       WKD
     R   .001  ,  .001  ,  .004  ,  .009  ,  .019  ,  .035  ,  .056  ,       WKD
     S   .000  ,  .000  ,  .001  ,  .001  ,  .002  ,  .005  ,  .009  ,       WKD
     T   .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,       WKD
     U   .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,       WKD
     V   .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,       WKD
     W   .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,       WKD
     X   .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,       WKD
     Y   .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  /       WKD
      DATA((POLFRT(I,J,2),J=1,7),I=1,13)/                                    SAT
```

```
          A    .777  ,  .288  ,  .067  ,  .013  ,  .006  ,  .001  ,  .000  ,         SAT
          B    .129  ,  .317  ,  .230  ,  .109  ,  .045  ,  .018  ,  .007  ,         SAT
          C    .044  ,  .169  ,  .218  ,  .175  ,  .105  ,  .057  ,  .030  ,         SAT
          D    .011  ,  .052  ,  .086  ,  .088  ,  .068  ,  .045  ,  .027  ,         SAT
          E    .008  ,  .038  ,  .071  ,  .081  ,  .071  ,  .052  ,  .035  ,         SAT
          F    .006  ,  .029  ,  .058  ,  .073  ,  .071  ,  .057  ,  .042  ,         SAT
          G    .004  ,  .022  ,  .047  ,  .065  ,  .068  ,  .059  ,  .047  ,         SAT
          H    .006  ,  .030  ,  .069  ,  .105  ,  .120  ,  .116  ,  .100  ,         SAT
          I    .004  ,  .019  ,  .046  ,  .077  ,  .099  ,  .107  ,  .102  ,         SAT
          J    .003  ,  .012  ,  .032  ,  .056  ,  .078  ,  .092  ,  .095  ,         SAT
          K    .002  ,  .008  ,  .022  ,  .041  ,  .061  ,  .077  ,  .085  ,         SAT
          L    .001  ,  .005  ,  .015  ,  .030  ,  .047  ,  .063  ,  .074  ,         SAT
          M    .001  ,  .004  ,  .011  ,  .022  ,  .036  ,  .051  ,  .062  /         SAT
           DATA((POLFRT(I,J,2),J=1,7),I=14,25)/                                      SAT
          N    .001  ,  .003  ,  .008  ,  .016  ,  .028  ,  .041  ,  .052  ,         SAT
          O    .001  ,  .002  ,  .006  ,  .012  ,  .021  ,  .033  ,  .043  ,         SAT
          P    .001  ,  .003  ,  .007  ,  .016  ,  .029  ,  .047  ,  .065  ,         SAT
          Q    .001  ,  .003  ,  .008  ,  .019  ,  .033  ,  .057  ,  .085  ,         SAT
          R    .001  ,  .001  ,  .004  ,  .009  ,  .019  ,  .035  ,  .056  ,         SAT
          S    .000  ,  .000  ,  .001  ,  .001  ,  .002  ,  .005  ,  .009  ,         SAT
          T    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SAT
          U    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SAT
          V    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SAT
          W    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SAT
          X    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SAT
          Y    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  /         SAT
           DATA((POLFRT(I,J,3),J=1,7),I=1,13)/
          A    .777  ,  .288  ,  .067  ,  .013  ,  .006  ,  .001  ,  .000  ,         SUN
          B    .129  ,  .317  ,  .230  ,  .109  ,  .045  ,  .018  ,  .007  ,         SUN
          C    .044  ,  .169  ,  .218  ,  .175  ,  .105  ,  .057  ,  .030  ,         SUN
          D    .011  ,  .052  ,  .086  ,  .088  ,  .068  ,  .045  ,  .027  ,         SUN
          E    .008  ,  .038  ,  .071  ,  .081  ,  .071  ,  .052  ,  .035  ,         SUN
          F    .006  ,  .029  ,  .058  ,  .073  ,  .071  ,  .057  ,  .042  ,         SUN
          G    .004  ,  .022  ,  .047  ,  .065  ,  .068  ,  .059  ,  .047  ,         SUN
          H    .006  ,  .030  ,  .069  ,  .105  ,  .120  ,  .116  ,  .100  ,         SUN
          I    .004  ,  .019  ,  .046  ,  .077  ,  .099  ,  .107  ,  .102  ,         SUN
          J    .003  ,  .012  ,  .032  ,  .056  ,  .078  ,  .092  ,  .095  ,         SUN
          K    .002  ,  .008  ,  .022  ,  .041  ,  .061  ,  .077  ,  .085  ,         SUN
          L    .001  ,  .005  ,  .015  ,  .030  ,  .047  ,  .063  ,  .074  ,         SUN
          M    .001  ,  .004  ,  .011  ,  .022  ,  .036  ,  .051  ,  .062  /         SUN
           DATA((POLFRT(I,J,3),J=1,7),I=14,25)/
          N    .001  ,  .003  ,  .008  ,  .016  ,  .028  ,  .041  ,  .052  ,         SUN
          O    .001  ,  .002  ,  .006  ,  .012  ,  .021  ,  .033  ,  .043  ,         SUN
          P    .001  ,  .003  ,  .007  ,  .016  ,  .029  ,  .047  ,  .065  ,         SUN
          Q    .001  ,  .003  ,  .008  ,  .019  ,  .033  ,  .057  ,  .085  ,         SUN
          R    .001  ,  .001  ,  .004  ,  .009  ,  .019  ,  .035  ,  .056  ,         SUN
          S    .000  ,  .000  ,  .001  ,  .001  ,  .002  ,  .005  ,  .009  ,         SUN
          T    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SUN
          U    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SUN
          V    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SUN
          W    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SUN
          X    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,         SUN
          Y    .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  ,  .000  /         SUN
           DATA  ((POLFRP(I,J,1),J=1,2),I=1,13) /                                     WKD
          A    0.2410, 0.1810 ,                                                      WKD
          B    0.1180, 0.0887 ,                                                      WKD
          C    0.1520, 0.1149 ,                                                      WKD
```

```
     D  0.1150, 0.0880 ,                                                WKD
     E  0.1240, 0.0982 ,                                                WKD
     F  0.0710, 0.0385 ,                                                WKD
     G  0.0410, 0.0405 ,                                                WKD
     H  0.0260, 0.0305 ,                                                WKD
     I  0.0180, 0.0252 ,                                                WKD
     J  0.0130, 0.0221 ,                                                WKD
     K  0.0110, 0.0203 ,                                                WKD
     L  0.0130, 0.0287 ,                                                WKD
     M  0.0220, 0.0553 /                                                WKD
      DATA ((POLFRP(I,J,1),J=1,2),I=14,25) /                            WKD
     N  0.0120, 0.0380 ,                                                WKD
     O  0.0070, 0.0259 ,                                                WKD
     P  0.0070, 0.0301 ,                                                WKD
     Q  0.0020, 0.0142 ,                                                WKD
     R  0.0010, 0.0110 ,                                                WKD
     S  0.0000, 0.0064 ,                                                WKD
     T  0.0000, 0.0038 ,                                                WKD
     U  0.0000, 0.0021 ,                                                WKD
     V  0.0000, 0.0009 ,                                                WKD
     W  0.0000, 0.0000 ,                                                WKD
     X  0.0000, 0.0000 ,                                                WKD
     Y  0.0000, 0.0000 /                                                WKD
      DATA ((POLFRP(I,J,2),J=1,2),I=1,13) /                             SAT
     A  0.2410, 0.1810 ,                                                SAT
     B  0.1180, 0.0887 ,                                                SAT
     C  0.1520, 0.1149 ,                                                SAT
     D  0.1150, 0.0880 ,                                                SAT
     E  0.1240, 0.0982 ,                                                SAT
     F  0.0710, 0.0385 ,                                                SAT
     G  0.0410, 0.0405 ,                                                SAT
     H  0.0260, 0.0305 ,                                                SAT
     I  0.0180, 0.0252 ,                                                SAT
     J  0.0130, 0.0221 ,                                                SAT
     K  0.0110, 0.0203 ,                                                SAT
     L  0.0130, 0.0287 ,                                                SAT
     M  0.0220, 0.0553 /                                                SAT
      DATA ((POLFRP(I,J,2),J=1,2),I=14,25) /                            SAT
     N  0.0120, 0.0380 ,                                                SAT
     O  0.0070, 0.0259 ,                                                SAT
     P  0.0070, 0.0301 ,                                                SAT
     Q  0.0020, 0.0142 ,                                                SAT
     R  0.0010, 0.0110 ,                                                SAT
     S  0.0000, 0.0064 ,                                                SAT
     T  0.0000, 0.0038 ,                                                SAT
     U  0.0000, 0.0021 ,                                                SAT
     V  0.0000, 0.0009 ,                                                SAT
     W  0.0000, 0.0000 ,                                                SAT
     X  0.0000, 0.0000 ,                                                SAT
     Y  0.0000, 0.0000 /                                                SAT
      DATA ((POLFRP(I,J,3),J=1,2),I=1,13) /                             SUN
     A  0.2410, 0.1810 ,                                                SUN
     B  0.1180, 0.0887 ,                                                SUN
     C  0.1520, 0.1149 ,                                                SUN
     D  0.1150, 0.0880 ,                                                SUN
     E  0.1240, 0.0982 ,                                                SUN
     F  0.0710, 0.0385 ,                                                SUN
     G  0.0410, 0.0405 ,                                          SUN
     H  0.0260, 0.0305 ,                                          SUN
     I  0.0180, 0.0252 ,                                          SUN
     J  0.0130, 0.0221 ,                                          SUN
     K  0.0110, 0.0203 ,                                          SUN
     L  0.0130, 0.0287 ,                                          SUN
     M  0.0220, 0.0553 /                                          SUN
      DATA ((POLFRP(I,J,3),J=1,2),I=14,25) /                      SUN
     N  0.0120, 0.0380 ,                                          SUN
     O  0.0070, 0.0259 ,                                          SUN
     P  0.0070, 0.0301 ,                                          SUN
     Q  0.0020, 0.0142 ,                                          SUN
     R  0.0010, 0.0110 ,                                          SUN
     S  0.0000, 0.0064 ,                                          SUN
     T  0.0000, 0.0038 ,                                          SUN
     U  0.0000, 0.0021 ,                                          SUN
     V  0.0000, 0.0009 ,                                          SUN
     W  0.0000, 0.0000 ,                                          SUN
     X  0.0000, 0.0000 ,                                          SUN
     Y  0.0000, 0.0000 /                                          SUN
      END
      BLOCK DATA NATPOP
      COMMON/TOTPOP/P(32,24,3)
      DATA ((P(I,J,1),J=1,24),I=1,4)/
     A49165015., 49842171., 50323418., 50469392., 50453410., 50322275.,
     B47727538., 38489899., 28359526., 24634137., 19977536., 23179919.,
     C29421948., 25524062., 21177257., 24519075., 21088961., 41284854.,
     D47953301., 46249738., 49002430., 49068674., 49371641., 49155531.,
     E       0.,        0.,        0.,        0.,        0.,        0.,
     F 1293562.,  3294132.,  2738201.,  1610992.,  2757266.,        0.,
     G       0.,   253786.,  4369018.,  1774254.,  3126098.,   645534.,
     H       0.,        0.,        0.,        0.,        0.,  2095759.,
     I       0.,        0.,        0.,        0.,        0.,        0.,
     J       0.,   589217.,        0.,  1155657.,        0.,        0.,
     K  965465.,  1483189.,  2409960.,   393660.,        0.,   111651.,
     L  447143.,  2457433.,        0.,        0.,   192069.,  1076578.,
     M       0.,        0.,        0.,        0.,        0.,        0.,
     N       0.,        0.,        0.,        0.,        0.,        0.,
     O  192069.,  3314698.,  2632114.,  3180132.,  7828125.,  6635101.,
     P       0.,        0.,        0.,  3895133.,  9103583.,  2298948.,
     DATA ((P(I,J,1),J=1,24),I=5,8)/
     A  777719.,   858956.,        0.,        0.,        0.,        0.,
     B       0.,        0., 14680521., 15615653., 15380564., 14925382.,
     C14022989., 14257687., 14597277., 14932097., 15340358.,   979469.,
     D  379313.,   553583.,   531769.,   622400.,   469656.,   590274.,
     E       0.,        0.,   230627.,        0.,        0.,        0.,
     F       0.,        0.,        0.,        0.,        0.,        0.,
     G       0.,        0.,        0.,        0.,        0.,   993437.,
     H       0.,        0.,        0.,        0.,        0.,        0.,
     I       0.,        0.,        0.,        0.,        0.,        0.,
     J       0.,        0.,        0.,        0.,        0.,        0.,
     K       0.,        0.,        0.,        0.,        0.,        0.,
     L       0.,        0.,        0.,        0.,        0.,        0.,
     M       0.,        0.,        0.,        0.,        0.,        0.,
     N       0.,        0.,        0.,        0.,   116844.,   212713.,
     O       0.,        0.,   212713.,   116844.,        0.,        0.,
     P       0.,        0.,        0.,        0.,        0.,        0./
     DATA ((P(I,J,1),J=1,24),I=9,12)/
     A 1205327.,   300598.,   301136.,   301461.,   301427.,   300464.,
     B  302032.,  7619925.,  9399576.,  8082861.,  7614269.,  9243893.,
     C 9581951.,  7804537., 10085488.,  8082861.,  1370629.,   902829.,
     D  903221.,   903479.,   904767.,   905260.,   905730.,  1204218.,
     E       0.,        0.,        0.,        0.,        0.,        0.,
     F 1162197.,  1159800.,  1159968.,  1160729.,        0.,        0.,
     G 1161110.,  1161065.,        0.,  1159587.,  3595580.,        0.,
     H       0.,        0.,        0.,        0.,        0.,        0.,
     I       0.,        0.,        0.,        0.,        0.,        0.,
     J       0.,        0.,        0.,        0.,  2664482.,        0.,
     K       0.,        0.,        0.,        0.,        0.,        0.,
     L       0.,        0.,        0.,        0.,        0.,        0.,
     M       0.,        0.,        0.,        0.,        0.,        0.,
     N       0.,        0.,   182375.,  1499090.,   474616.,  1499090.,
     O       0.,  1777414.,   656991.,  1499090.,  1499090.,        0.,
     P       0.,        0.,        0.,        0.,        0.,        0./
     DATA ((P(I,J,1),J=1,24),I=13,16)/
     A86130233., 87040796., 87776520., 88100716., 88100704., 88100383.,
     B84596185., 70521658., 53444637., 46014177., 37688767., 42429594.,
     C55914265., 48813775., 41006425., 46661325., 35052502., 72797977.,
     D83932771., 81933019., 86420767., 86423733., 86423355., 86127862.,
     E       0.,        0.,        0.,        0.,        0.,        0.,
     F 2410976.,  7953206.,  5607554.,  3014452.,  4487373.,        0.,
     G       0.,   489617.,  8048922.,  3806766.,  6725359.,  1372310.,
     H  672102.,        0.,        0.,        0.,        0.,  3163320.,
     I       0.,        0.,        0.,        0.,        0.,        0.,
     J       0.,  1256062.,        0.,  1977865.,        0.,   132075.,
     K 1646203.,  2435232.,  4124405.,   835274.,   423024.,  1211980.,
     L 1815203.,  4496270.,        0.,        0.,        0.,        0.,
     M       0.,        0.,        0.,        0.,        0.,        0.,
     N       0.,        0.,        0.,  6972740., 15810465., 14057587.,
     O  423024.,  6244020.,  4800733.,  6673752., 19296863.,  4809671.,
     P       0.,        0.,        0.,        0.,        0.,        0./
      DATA ((P(I,J,1),J=1,24),I=17,20)/
     A  777021.,   777290.,        0.,        0.,        0.,        0.,
     B       0.,        0., 13060313., 13531034., 12858398., 13532136.,
     C13897516., 12858398., 13285185., 13722272., 14319249.,   777768.,
     D  746257.,   754060.,   755558.,   764620.,   763643.,   769539.,
     E       0.,        0.,   239001.,        0.,        0.,        0.,
     F       0.,        0.,        0.,   182265.,   606785.,        0.,
     G       0.,   916236.,        0.,        0.,        0.,  3097123.,
     H       0.,        0.,        0.,        0.,        0.,        0.,
     I       0.,        0.,        0.,        0.,        0.,        0.,
     J       0.,        0.,   108557.,   168502.,   299246.,   168502.,
     K       0.,   108557.,   409054.,    59039.,   108557.,        0.,
     L       0.,        0.,        0.,        0.,        0.,        0.,
     M       0.,        0.,        0.,        0.,        0.,        0.,
     N       0.,        0.,        0.,        0.,   108557.,   195005.,
     O       0.,        0.,   195005.,   108557.,        0.,        0.,
     P       0.,        0.,        0.,        0.,        0.,        0./
      DATA ((P(I,J,1),J=1,24),I=21,24)/
     A  918661.,   230634.,   230993.,   231209.,   231187.,   230545.,
     B  231590.,  5895017.,  7232337.,  6249720.,  5891246.,  7122276.,
     C 7379715.,  6039253.,  7742569.,  6249720.,  1042014.,   682578.,
     D  682840.,   683011.,   683870.,   684198.,   684512.,   917922.,
     E       0.,        0.,        0.,        0.,        0.,        0.,
     F  863811.,   862213.,   862325.,   862833.,        0.,        0.,
     G  863087.,   863057.,        0.,   862071.,  2699788.,        0.,
     H       0.,        0.,        0.,        0.,        0.,        0.,
     I       0.,        0.,        0.,        0.,        0.,        0.,
     J       0.,        0.,        0.,        0.,  1985997.,        0.,
     K       0.,        0.,        0.,        0.,        0.,        0.,
     L       0.,        0.,        0.,        0.,        0.,        0.,
     M       0.,        0.,        0.,        0.,        0.,        0.,
     N       0.,        0.,   146473.,  1119222.,   354703.,  1119222.,
     O       0.,  1339557.,   499844.,  1119222.,  1119222.,        0.,
     P       0.,        0.,        0.,        0.,        0.,        0./
      DATA ((P(I,J,1),J=1,24),I=25,28)/
     A  198764.,   118601.,    69144.,    69144.,    85082.,   214932.,
     B  541902.,  1385258.,  1923246.,  1732214.,  1826915.,  2230800.,
     C 3349644.,  3104685.,  2567648.,  2302050.,  2680365.,  2637023.,
     D 1422336.,   969932.,   717717.,   608954.,   453315.,   356277.,
     E    7466.,     4779.,     2987.,     1904.,     2016.,     5227.,
     F   14821.,    22810.,    22250.,    19712.,    18853.,    18704.,
     G   18442.,    18592.,    20384.,    23519.,    25685.,    23669.,
     H   22362.,    21503.,    17210.,    15568.,    14000.,    11162.,
     I       0.,        0.,        0.,        0.,        0.,        0.,
     J   18704.,     130928.,     242586.,     367091.,     403177.,     330628.,
     K  326660.,     343664.,     317025.,     359345.,     370303.,     346875.,
     L  195165.,     156623.,     136596.,      77272.,      84830.,      47421.,
     M       0.,          0.,          0.,          0.,          0.,          0.,
     N       0.,          0.,          0.,          0.,          0.,          0.,
     O       0.,          0.,          0.,          0.,          0.,          0.,
     P       0.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,1),J=1,24),I=29,32)/
     A87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     B87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     C87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     D87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     E       0.,          0.,          0.,          0.,          0.,          0.,
     F       0.,          0.,          0.,          0.,          0.,          0.,
     G       0.,          0.,          0.,          0.,          0.,          0.,
     H       0.,          0.,          0.,          0.,          0.,          0.,
     I       0.,          0.,          0.,          0.,          0.,          0.,
     J       0.,          0.,          0.,          0.,          0.,          0.,
     K       0.,          0.,          0.,          0.,          0.,          0.,
     L       0.,          0.,          0.,          0.,          0.,          0.,
     M       0.,          0.,          0.,          0.,          0.,          0.,
     N       0.,          0.,          0.,          0.,          0.,          0.,
     O       0.,          0.,          0.,          0.,          0.,          0.,
     P       0.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,2),J=1,24),I=1,4)/
     A50016569., 50125665., 50242866., 50431431., 50522109., 50495415.,
     B50361663., 50202983., 50201501., 32005147., 25437801., 42484440.,
     C47083276., 36875936., 14658594., 26289070., 43914811., 47189124.,
     D49273980., 39215619., 44492013., 49559709., 49583749., 49842159.,
     E       0.,          0.,          0.,          0.,          0.,          0.,
     F       0.,          0.,          0.,    8945485.,    6550341.,     919937.,
     G 1919905.,    5831057.,    9177135.,    1339600.,    2340517.,     322519.,
     H   50471.,    7392125.,    4331413.,     492730.,     498855.,          0.,
     I       0.,          0.,          0.,          0.,          0.,          0.,
     J       0.,          0.,          0.,     965465.,    8200614.,     111651.,
     K       0.,    3060970.,    7698840.,    5083375.,     771736.,    1914699.,
     L  322519.,    3312374.,    1155657.,          0.,          0.,          0.,
     M       0.,          0.,          0.,          0.,          0.,          0.,
     N       0.,          0.,          0.,    8093168.,    8966303.,    5730261.,
     O       0.,    2917852.,   17154931.,   16179148.,    1980306.,          0.,
     P  123233.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,2),J=1,24),I=5,8)/
     A       0.,          0.,          0.,          0.,          0.,          0.,
     B       0.,          0.,          0.,          0.,          0.,          0.,
     C       0.,          0.,          0.,          0.,          0.,          0.,
     D       0.,          0.,          0.,          0.,          0.,          0.,
     E       0.,          0.,          0.,          0.,          0.,          0.,
     F       0.,          0.,          0.,          0.,          0.,          0.,
     G       0.,          0.,          0.,          0.,          0.,          0.,
     H       0.,          0.,          0.,          0.,          0.,          0.,
     I       0.,          0.,          0.,          0.,          0.,          0.,
     J       0.,          0.,          0.,          0.,          0.,          0.,
     K       0.,          0.,          0.,          0.,          0.,          0.,
     L       0.,          0.,          0.,          0.,          0.,          0.,
     M       0.,          0.,          0.,          0.,          0.,          0.,
     N       0.,          0.,          0.,          0.,     212713.,          0.,
     O       0.,     212713.,          0.,          0.,          0.,          0.,
P       0.,        0.,        0.,        0.,        0.,        0./
  DATA ((P(I,J,2),J=1,24),I=9,12)/
A       0.,        0.,        0.,        0.,        0.,        0.,
B       0.,        0.,        0.,        0.,        0.,        0.,
C       0.,        0.,        0.,        0.,        0.,        0.,
D       0.,        0.,        0.,        0.,        0.,        0.,
E       0.,        0.,        0.,        0.,        0.,        0.,
F       0.,        0.,        0.,        0.,        0.,        0.,
G       0.,        0.,        0.,        0.,        0.,        0.,
H       0.,        0.,        0.,        0.,        0.,        0.,
I       0.,        0.,        0.,        0.,        0.,        0.,
J       0.,        0.,        0.,        0.,        0.,        0.,
K       0.,        0.,        0.,        0.,        0.,        0.,
L       0.,        0.,        0.,        0.,        0.,        0.,
M       0.,        0.,        0.,        0.,        0.,        0.,
N       0.,        0.,        0.,        0.,        0.,        0.,
O       0.,        0.,        0.,        0.,        0.,        0.,
P       0.,        0.,        0.,        0.,        0.,        0./
  DATA ((P(I,J,2),J=1,24),I=13,16)/
A88329959., 88397634., 88400914., 88403747., 88403927., 88404510.,
B88390336., 88380867., 87769894., 57631260., 45285644., 73757718.,
C83334542., 64331774., 25814180., 47694445., 78635548., 84315769.,
D86546516., 67029268., 77675979., 86677196., 86754511., 88388734.,
E       0.,        0.,        0.,        0.,        0.,        0.,
F       0.,        0.,        0., 13246805., 13503738.,  1754421.,
G 3477994., 10888320., 13559402.,  2186378.,  3964874.,   506800.,
H   83810., 14239118.,  7937841.,  1052174.,  1086045.,        0.,
I       0.,        0.,        0.,        0.,        0.,        0.,
J       0.,        0.,        0.,  1646203., 13540123.,   132075.,
K       0.,  6039525., 14205879.,  7086390.,  1282304.,  2360084.,
L  506800.,  6241877.,  1977865.,        0.,        0.,        0.,
M       0.,        0.,        0.,        0.,        0.,        0.,
N       0.,        0.,        0., 15058724., 14656834., 11358942.,
O       0.,  5292312., 32933401., 29656115.,  3022939.,        0.,
P  283500.,        0.,        0.,        0.,        0.,        0./
  DATA ((P(I,J,2),J=1,24),I=17,20)/
A       0.,        0.,        0.,        0.,        0.,        0.,
B       0.,        0.,   195005.,        0.,        0.,   195005.,
C  195005.,        0.,        0.,   195005.,        0.,        0.,
D       0.,        0.,        0.,        0.,        0.,        0.,
E       0.,        0.,        0.,        0.,        0.,        0.,
F       0.,        0.,        0.,   195005.,        0.,        0.,
G       0.,        0.,   195005.,        0.,        0.,        0.,
H       0.,        0.,        0.,        0.,        0.,        0.,
I       0.,        0.,        0.,        0.,        0.,        0.,
J       0.,        0.,        0.,        0.,        0.,        0.,
K       0.,        0.,        0.,        0.,        0.,        0.,
L       0.,        0.,        0.,        0.,        0.,        0.,
M       0.,        0.,        0.,        0.,        0.,        0.,
N       0.,        0.,        0.,        0.,   195005.,        0.,
O       0.,   195005.,        0.,        0.,        0.,        0.,
P       0.,        0.,        0.,        0.,        0.,        0./
  DATA ((P(I,J,2),J=1,24),I=21,24)/
A       0.,        0.,        0.,        0.,        0.,        0.,
B       0.,        0.,        0.,        0.,        0.,        0.,
C       0.,        0.,        0.,        0.,        0.,        0.,
D       0.,        0.,        0.,        0.,        0.,        0.,
     E       0.,          0.,          0.,          0.,          0.,          0.,
     F       0.,          0.,          0.,          0.,          0.,          0.,
     G       0.,          0.,          0.,          0.,          0.,          0.,
     H       0.,          0.,          0.,          0.,          0.,          0.,
     I       0.,          0.,          0.,          0.,          0.,          0.,
     J       0.,          0.,          0.,          0.,          0.,          0.,
     K       0.,          0.,          0.,          0.,          0.,          0.,
     L       0.,          0.,          0.,          0.,          0.,          0.,
     M       0.,          0.,          0.,          0.,          0.,          0.,
     N       0.,          0.,          0.,          0.,          0.,          0.,
     O       0.,          0.,          0.,          0.,          0.,          0.,
     P       0.,          0.,          0.,          0.,          0.,          0.,
             0.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,2),J=1,24),I=25,28)/
     A   739965.,     632872.,     517077.,     329726.,     239125.,     266070.,
     B   393746.,     548368.,     873348.,    1169844.,    1733340.,    2346215.,
     C  2708582.,    3002317.,    3160219.,    2817160.,    2595082.,    1913576.,
     D  1321649.,    1075442.,    1011476.,     996258.,    1049728.,     912564.,
     E    21190.,      14512.,       9825.,       5779.,       5522.,       4688.,
     F    12522.,      19842.,      23245.,      26520.,      30437.,      38078.,
     G    36794.,      37179.,      36345.,      41546.,      39812.,      35959.,
     H    37436.,      40775.,      36088.,      31914.,      29281.,      27226.,
     I       0.,          0.,          0.,          0.,          0.,          0.,
     J    12415.,      18623.,     105531.,     186231.,     254516.,     329008.,
     K   415916.,     499720.,     558693.,     599043.,     614562.,     620770.,
     L   620770.,     614562.,     543174.,     372462.,     167608.,          0.,
     M       0.,          0.,          0.,          0.,          0.,          0.,
             0.,          0.,          0.,          0.,          0.,          0.,
     O       0.,          0.,          0.,          0.,          0.,          0.,
     P       0.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,2),J=1,24),I=29,32)/
     A87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     B87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     C87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     D87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     E       0.,          0.,          0.,          0.,          0.,          0.,
     F       0.,          0.,          0.,          0.,          0.,          0.,
             0.,          0.,          0.,          0.,          0.,          0.,
     H       0.,          0.,          0.,          0.,          0.,          0.,
     I       0.,          0.,          0.,          0.,          0.,          0.,
     J       0.,          0.,          0.,          0.,          0.,          0.,
     K       0.,          0.,          0.,          0.,          0.,          0.,
     L       0.,          0.,          0.,          0.,          0.,          0.,
     M       0.,          0.,          0.,          0.,          0.,          0.,
     N       0.,          0.,          0.,          0.,          0.,          0.,
     O       0.,          0.,          0.,          0.,          0.,          0.,
     P       0.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,3),J=1,24),I=1,4)/
     A50129145., 49514862., 50324752., 49661411., 50562637., 50592232.,
     B50555239., 47958373., 45770803., 37314179., 38730925., 42184270.,
     C48869424., 42329511., 27344922., 22326152., 33251843., 47094618.,
     D47399435., 49539816., 48509745., 50426825., 50440979., 50495360.,
     E       0.,          0.,          0.,     711660.,          0.,          0.,
     F       0.,    2544544.,    4545994.,   11960969.,    9596530.,          0.,
     G  1233505.,    1877119.,     558274.,     127454.,    2665200.,    6003910.,
     H   344736.,     848468.,    1896556.,          0.,          0.,          0.,
     I       0.,          0.,          0.,          0.,          0.,          0.,
     J       0.,          0.,          0.,          0.,    1318579.,     750850.,
K       0.,   909768.,  1948858.,  2211556.,  1667540.,  2905880.,
L 2592709.,        0.,        0.,        0.,        0.,        0.,
M       0.,   711660.,        0.,    99897.,        0.,        0.,
N       0.,        0.,   215880.,  1179108.,   684799.,  1266719.,
O       0.,  4927702., 20129626., 25244144., 12357123.,   215880.,
P       0.,        0.,        0.,        0.,        0.,        0./
  DATA ((P(I,J,3),J=1,24),I=5,8)/
A       0.,        0.,        0.,        0.,        0.,        0.,
B       0.,        0.,        0.,        0.,        0.,        0.,
C       0.,        0.,        0.,        0.,   212713.,        0.,
D       0.,        0.,        0.,        0.,        0.,        0.,
E       0.,        0.,        0.,        0.,        0.,        0.,
F       0.,        0.,        0.,        0.,        0.,        0.,
G       0.,        0.,   212713.,        0.,        0.,        0.,
H       0.,        0.,        0.,        0.,        0.,        0.,
I       0.,        0.,        0.,        0.,        0.,        0.,
J       0.,        0.,        0.,        0.,        0.,        0.,
K       0.,        0.,        0.,        0.,        0.,        0.,
L       0.,        0.,        0.,        0.,        0.,        0.,
M       0.,        0.,        0.,        0.,        0.,        0.,
N       0.,        0.,        0.,        0.,        0.,        0.,
O       0.,        0.,        0.,   212713.,        0.,        0.,
P       0.,        0.,        0.,        0.,        0.,        0./
  DATA ((P(I,J,3),J=1,24),I=9,12)/
A       0.,        0.,        0.,        0.,        0.,        0.,
B       0.,        0.,        0.,        0.,        0.,        0.,
C       0.,        0.,        0.,        0.,        0.,        0.,
D       0.,        0.,        0.,        0.,        0.,        0.,
E       0.,        0.,        0.,        0.,        0.,        0.,
F       0.,        0.,        0.,        0.,        0.,        0.,
G       0.,        0.,        0.,        0.,        0.,        0.,
H       0.,        0.,        0.,        0.,        0.,        0.,
I       0.,        0.,        0.,        0.,        0.,        0.,
J       0.,        0.,        0.,        0.,        0.,        0.,
K       0.,        0.,        0.,        0.,        0.,        0.,
L       0.,        0.,        0.,        0.,        0.,        0.,
M       0.,        0.,        0.,        0.,        0.,        0.,
N       0.,        0.,        0.,        0.,        0.,        0.,
O       0.,        0.,        0.,        0.,        0.,        0.,
P       0.,        0.,        0.,        0.,        0.,        0./
  DATA ((P(I,J,3),J=1,24),I=13,16)/
A88398189., 87015518., 88403339., 86847312., 88405289., 88405667.,
B88402117., 82923945., 79499741., 63914465., 70791703., 73206787.,
C85761072., 75510368., 49219818., 39253396., 56054105., 83163474.,
D83258265., 87034752., 85992004., 88173418., 88183705., 88220624.,
E       0.,        0.,        0.,  1388841.,        0.,        0.,
F       0.,  5440332.,  8349431., 22215534., 13594792., 11051635.,
G 2108320.,  3402922.,  1187820.,   201394.,  5035675.,        0.,
H  681860.,  1104662.,  2160866.,        0.,        0.,        0.,
I       0.,        0.,        0.,        0.,        0.,        0.,
J       0.,        0.,        0.,        0.,  2183882.,  1623694.,
K       0.,  1636635.,  3015682.,  3819036.,  2044025.,  4507881.,
L 4164608.,        0.,        0.,        0.,        0.,        0.,
M       0.,  1388841.,        0.,   160404.,        0.,        0.,
N       0.,        0.,   324386.,  1980111.,  1463439.,  2060135.,
O       0.,  7274005., 34173561., 44273732., 24448306.,   324386.,
P       0.,        0.,        0.,        0.,        0.,        0./
```

```
      DATA ((P(I,J,3),J=1,24),I=17,20)/
     A      0.,          0.,          0.,          0.,          0.,          0.,
     B      0.,          0.,          0.,          0.,          0.,          0.,
     C      0.,          0.,          0.,          0.,     195005.,          0.,
     D      0.,          0.,          0.,          0.,          0.,          0.,
     E      0.,          0.,          0.,          0.,          0.,          0.,
     F      0.,          0.,          0.,          0.,          0.,          0.,
     G      0.,          0.,     195005.,          0.,          0.,          0.,
     H      0.,          0.,          0.,          0.,          0.,          0.,
     I      0.,          0.,          0.,          0.,          0.,          0.,
     J      0.,          0.,          0.,          0.,          0.,          0.,
     K      0.,          0.,          0.,          0.,          0.,          0.,
     L      0.,          0.,          0.,          0.,          0.,          0.,
     M      0.,          0.,          0.,          0.,          0.,          0.,
     N      0.,          0.,          0.,          0.,          0.,          0.,
     O      0.,          0.,          0.,     195005.,          0.,          0.,
     P      0.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,3),J=1,24),I=21,24)/
     A      0.,          0.,          0.,          0.,          0.,          0.,
     B      0.,          0.,          0.,          0.,          0.,          0.,
     C      0.,          0.,          0.,          0.,          0.,          0.,
     D      0.,          0.,          0.,          0.,          0.,          0.,
     E      0.,          0.,          0.,          0.,          0.,          0.,
     F      0.,          0.,          0.,          0.,          0.,          0.,
     G      0.,          0.,          0.,          0.,          0.,          0.,
     H      0.,          0.,          0.,          0.,          0.,          0.,
     I      0.,          0.,          0.,          0.,          0.,          0.,
     J      0.,          0.,          0.,          0.,          0.,          0.,
     K      0.,          0.,          0.,          0.,          0.,          0.,
     L      0.,          0.,          0.,          0.,          0.,          0.,
     M      0.,          0.,          0.,          0.,          0.,          0.,
     N      0.,          0.,          0.,          0.,          0.,          0.,
     O      0.,          0.,          0.,          0.,          0.,          0.,
     P      0.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,3),J=1,24),I=25,28)/
     A 629630.,     533550.,     436231.,     290131.,     199181.,     169748.,
     B 205220.,     253097.,     331752.,     442570.,     631136.,     854517.,
     C1008919.,    1122137.,    1218473.,    1123189.,    1088442.,     892090.,
     D 717496.,     627015.,     596417.,     549778.,     527041.,     437072.,
     E  13719.,       9396.,       6361.,       3742.,       3575.,       3035.,
     F   8107.,      12846.,      15050.,      17170.,      19706.,      24653.,
     G  23822.,      24071.,      23531.,      26898.,      25776.,      23281.,
     H  24238.,      26399.,      23365.,      20662.,      18958.,      17627.,
     I      0.,          0.,          0.,          0.,          0.,          0.,
     J      0.,      38798.,     116394.,     155193.,     155193.,     155193.,
     K 155193.,     155193.,     155193.,     155193.,     116394.,      38798.,
     L      0.,          0.,          0.,          0.,          0.,          0.,
     M      0.,          0.,          0.,          0.,          0.,          0.,
     N      0.,          0.,          0.,          0.,          0.,          0.,
     O      0.,          0.,          0.,          0.,          0.,          0.,
     P      0.,          0.,          0.,          0.,          0.,          0./
      DATA ((P(I,J,3),J=1,24),I=29,32)/
     A87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     B87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     C87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     D87334142., 87334142., 87334142., 87334142., 87334142., 87334142.,
     E      0.,         0.,         0.,         0.,         0.,         0.,
     F    0.,        0.,        0.,        0.,        0.,        0.,
     G    0.,        0.,        0.,        0.,        0.,        0.,
     H    0.,        0.,        0.,        0.,        0.,        0.,
     I    0.,        0.,        0.,        0.,        0.,        0.,
     J    0.,        0.,        0.,        0.,        0.,        0.,
     K    0.,        0.,        0.,        0.,        0.,        0.,
     L    0.,        0.,        0.,        0.,        0.,        0.,
     M    0.,        0.,        0.,        0.,        0.,        0.,
     N    0.,        0.,        0.,        0.,        0.,        0.,
     O    0.,        0.,        0.,        0.,        0.,        0.,
     P    0.,        0.,        0.,        0.,        0.,        0./
      END
      BLOCK DATA POLCON
      COMMON/CONC/CONVAL(25,32,3)
      DATA ((CONVAL(I,J,1),I=1,25),J=4,24,4) /
     A    0.,    36.,   109.,   180.,   253.,   325.,   398.,   470.,   541.,
     B  614.,   686.,   759.,   831.,   904.,   975.,  1120.,  1337.,
     C 1554.,  1770.,  2132.,  2150.,  2175.,  2200.,  2225.,  2250.,
     D    0.,    38.,   116.,   192.,   270.,   346.,   422.,   500.,   576.,
     E  654.,   730.,   808.,   884.,   961.,  1038.,  1192.,  1422.,
     F 1653.,  1884.,  2268.,  2300.,  2325.,  2350.,  2375.,  2400.,
     G    0.,    38.,   116.,   192.,   270.,   346.,   422.,   500.,   576.,
     H  654.,   730.,   808.,   884.,   961.,  1038.,  1192.,  1422.,
     I 1653.,  1884.,  2268.,  2300.,  2325.,  2350.,  2375.,  2400.,
     J    0.,    36.,   109.,   180.,   253.,   325.,   398.,   470.,   541.,
     K  614.,   686.,   759.,   831.,   904.,   975.,  1120.,  1337.,
     L 1554.,  1770.,  2132.,  2150.,  2175.,  2200.,  2225.,  2250.,
     M    0.,    36.,   109.,   180.,   253.,   325.,   398.,   470.,   541.,
     N  614.,   686.,   759.,   831.,   904.,   975.,  1120.,  1337.,
     O 1554.,  1770.,  2132.,  2150.,  2175.,  2200.,  2225.,  2250.,
     P    0.,    36.,   109.,   180.,   253.,   325.,   398.,   470.,   541.,
     Q  614.,   686.,   759.,   831.,   904.,   975.,  1120.,  1337.,
     R 1554.,  1770.,  2132.,  2150.,  2175.,  2200.,  2225.,  2250./
      DATA ((CONVAL(I,J,1), I=1,25),J=25,28) /
     A    0.,    38.,   116.,   192.,   270.,   346.,   422.,   500.,   576.,
     B  654.,   730.,   808.,   884.,   961.,  1038.,  1192.,  1422.,
     C 1653.,  1884.,  2268.,  2300.,  2325.,  2350.,  2375.,  2400.,
     D    0.,   200.,   400.,   600.,   700.,   800.,   900.,  1000.,  1200.,
     E 1400.,  1600.,  1800.,  2000.,  2200.,  2400.,  2600.,  3000.,
     F 4000.,  6000.,  8000.,  8100.,  8200.,  8300.,  8400.,  8500.,
     G    0.,   360.,   463.,   618.,   773.,  1030.,  1288.,  1546.,  1804.,
     H 2061.,  2319.,  2577.,  3000.,  4000.,  5000.,  6000.,  8000.,
     I10000.,15000.,20000.,25000.,30000.,35000.,40000.,50000.,
     J    0.,    38.,   116.,   192.,   270.,   346.,   422.,   500.,   576.,
     K  654.,   730.,   808.,   884.,   961.,  1038.,  1192.,  1422.,
     L 1653     884.,  2268.,  2300.,  2325.,  2350.,  2375.,  2400./
      DATA (CONVAL(I,32,1),I=1,25) /
     M    0.,    37.,    75.,   112.,   149.,   200.,   225.,   250.,   300.,
     N  325.,   350.,   375.,   400.,   425.,   450.,   475.,   500.,
     O  525.,   550.,   575.,   600.,   625.,   650.,   675.,   700./
      DATA ((CONVAL(I,J,2),I=1,25),J=4,24,4) /
     A    0.,    50.,   152.,   250.,   352.,   452.,   553.,   653.,   752.,
     B  853.,   954.,  1055.,  1151.,  1257.,  1355.,  1557.,  1858.,
     C 2160.,  2460.,  2963.,  2989.,  3023.,  3058.,  3093.,  3128.,
     D    0.,    53.,   161.,   267.,   375.,   481.,   587.,   695.,   801.,
     E  909.,  1015.,  1123.,  1229.,  1336.,  1443.,  1657.,  1977.,
     F 2298.,  2619.,  3153.,  3197.,  3232.,  3267.,  3301.,  3336.,
     G    0.,    53.,   161.,   267.,   375.,   481.,   587.,   695.,   801.,
     H  909.,  1015.,  1123.,  1229.,  1336.,  1443.,  1657.,  1977.,
     I 2298.,  2619.,  3153.,  3197.,  3232.,  3267.,  3301.,  3336.,
     J    0.,    50.,   152.,   250.,   352.,   452.,   553.,   653.,   752.,
     K  853.,   954.,  1055.,  1151.,  1257.,  1355.,  1557.,  1858.,
     L 2160.,  2460.,  2963.,  2989.,  3023.,  3058.,  3093.,  3128.,
     M    0.,    50.,   152.,   250.,   352.,   452.,   553.,   653.,   752.,
     N  853.,   954.,  1055.,  1151.,  1257.,  1355.,  1557.,  1858.,
     O 2160.,  2460.,  2963.,  2989.,  3023.,  3058.,  3093.,  3128.,
     P    0.,    50.,   152.,   250.,   352.,   452.,   553.,   653.,   752.,
     Q  853.,   954.,  1055.,  1151.,  1257.,  1355.,  1557.,  1858.,
     R 2160.,  2460.,  2963.,  2989.,  3023.,  3058.,  3093.,  3128./
```

```
      DATA ((CONVAL(I,J,2),I=1,25),J=25,28) /
     A    0.,   53.,  161.,  267.,  375.,  481.,  587.,  695.,   801.,
     B  909., 1015., 1123., 1229., 1336., 1443., 1657., 1977.,
     C 2298., 2619., 3153., 3197., 3232., 3267., 3301., 3336.,
     D    0.,  200.,  400.,  600.,  700.,  800.,  900., 1000.,  1200.,
     E 1400., 1600., 1800., 2000., 2200., 2400., 2600., 3000.,
     F 4000., 6000., 8000., 8100., 8200., 8300., 8400., 8500.,
     G    0.,  360.,  463.,  618.,  773., 1030., 1288., 1546.,  1804.,
     H 2061., 2319., 2577., 3000., 4000., 5000., 6000., 8000.,
     I10000.,15000.,20000.,25000.,30000.,35000.,40000.,50000.,
     J    0.,   53.,  161.,  267.,  375.,  481.,  587.,  695.,   801.,
     K  909., 1015., 1123., 1229., 1336., 1443., 1657., 1977.,
     L 2298., 2619., 3153., 3197., 3232., 3267., 3301., 3336./
      DATA (CONVAL(I,32,2),I=1,25) /
     M    0.,   51.,  104.,  156.,  207.,  278.,  313.,  348.,   417.,
     N  452.,  487.,  521.,  556.,  591.,  626.,  660.,  695.,
     O  730.,  765.,  799.,  834.,  869.,  904.,  938.,  973./
      DATA ((CONVAL(I,J,3),I=1,25),J=4,24,4) /
     A    0.,   50.,  152.,  250.,  352.,  452.,  553.,  653.,   752.,
     B  853.,  954., 1055., 1151., 1257., 1355., 1557., 1858.,
     C 2160., 2460., 2963., 2989., 3023., 3058., 3093., 3128.,
     D    0.,   53.,  161.,  267.,  375.,  481.,  587.,  695.,   801.,
     E  909., 1015., 1123., 1229., 1336., 1443., 1657., 1977.,
     F 2298., 2619., 3153., 3197., 3232., 3267., 3301., 3336.,
     G    0.,   53.,  161.,  267.,  375.,  481.,  587.,  695.,   801.,
     H  909., 1015., 1123., 1229., 1336., 1443., 1657., 1977.,
     I 2298., 2619., 3153., 3197., 3232., 3267., 3301., 3336.,
     J    0.,   50.,  152.,  250.,  352.,  452.,  553.,  653.,   752.,
     K  853.,  954., 1055., 1151., 1257., 1355., 1557., 1858.,
     L 2160., 2460., 2963., 2989., 3023., 3058., 3093., 3128.,
     M    0.,   50.,  152.,  250.,  352.,  452.,  553.,  653.,   752.,
     N  853.,  954., 1055., 1151., 1257., 1355., 1557., 1858.,
     O 2160., 2460., 2963., 2989., 3023., 3058., 3093., 3128.,
     P    0.,   50.,  152.,  250.,  352.,  452.,  553.,  653.,   752.,
     O  853.,  954., 1055., 1151., 1257., 1355., 1557., 1858.,
     R 2160., 2460., 2963., 2989., 3023., 3058., 3093., 3128./
      DATA ((CONVAL(I,J,3),I=1,25),J=25,28) /
     A    0.,   53.,  161.,  267.,  375.,  481.,  587.,  695.,   801.,
     B  909., 1015., 1123., 1229., 1336., 1443., 1657., 1977.,
     C 2298., 2619., 3153., 3197., 3232., 3267., 3301., 3336.,
     D    0.,  200.,  400.,  600.,  700.,  800.,  900., 1000.,  1200.,
     E 1400., 1600., 1800., 2000., 2200., 2400., 2600., 3000.,
     F 4000., 6000., 8000., 8100., 8200., 8300., 8400., 8500.,
     G    0.,  360.,  463.,  618.,  773., 1030., 1288., 1546.,  1804.,
     H 2061., 2319., 2577., 3000., 4000., 5000., 6000., 8000.,
     I10000.,15000.,20000.,25000.,30000.,35000.,40000.,50000.,
     J    0.,   53.,  161.,  267.,  375.,  481.,  587.,  695.,   801.,
     K  909., 1015., 1123., 1229., 1336., 1443., 1657., 1977.,
     L 2298., 2619., 3153., 3197., 3232., 3267., 3301., 3336./
      DATA (CONVAL(I,32,3),I=1,25) /
     M    0.,   51.,  104.,  156.,  207.,  278.,  313.,  348.,   417.,
     N  452.,  487.,  521.,  556.,  591.,  626.,  660.,  695.,
     O  730.,  765.,  799.,  834.,  869.,  904.,  938.,  973./
      END
      BLOCK DATA NERCON
      COMMON/PLFRC1/ POLFR1(25,6,3),POLFR2(25,6,3),POLFR3(25,6,3),
     1               POLFR4(25,6,3),POLFR5(25,6,3),POLFR6(25,6,3)
      DATA ((POLFR1(I,J,1),J=1,6),I=1,13)/
     A        .4280,  .3140,  .1770,  .3280,  .2300,  .2480,           WKD
     B        .4330,  .4540,  .4410,  .4810,  .4310,  .4550,           WKD
     C        .0830,  .1330,  .1930,  .1390,  .1970,  .1660,           WKD
     D        .0310,  .0610,  .0820,  .0370,  .0740,  .0620,           WKD
     E        .0120,  .0220,  .0390,  .0080,  .0270,  .0280,           WKD
     F        .0060,  .0090,  .0250,  .0030,  .0140,  .0160,           WKD
     G        .0030,  .0050,  .0150,  .0010,  .0060,  .0090,           WKD
     H        .0010,  .0020,  .0090,  .0010,  .0030,  .0050,           WKD
     I        .0010,  .0010,  .0050,  .0002,  .0030,  .0040,           WKD
     J        .0003,  .0002,  .0040,  .0001,  .0010,  .0020,           WKD
     K        .0004,  .0004,  .0040,  .0001,  .0010,  .0010,           WKD
     L        .0003,  .0000,  .0020,  .0001,  .0010,  .0010,           WKD
     M        .0001,  .0000,  .0010,  .0000,  .0010,  .0010/           WKD
      DATA ((POLFR1(I,J,1),J=1,6),I=14,25)/
     N        .0002,  .0002,  .0010,  .0000,  .0004,  .0004,           WKD
     O        .0000, .0000,  .0010,  .0000,  .0010,  .0004,           WKD
     P        .0001,  .0000,  .0010,  .0000,  .0010,  .0002,           WKD
     O        .0001,  .0000,  .0002,  .0000,  .0004,  .0000,           WKD
     R        .0000,  .0000,  .0001,  .0001,  .0001,  .0001,           WKD
     S        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           WKD
     T        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           WKD
     U        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           WKD
     V        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           WKD
     W        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           WKD
     X        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           WKD
     Y        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/           WKD
      DATA ((POLFR1(I,J,2),J=1,6),I=1,13)/
     A        .2940,  .3640,  .2740,  .3390,  .3530,  .2940,           SAT
     B        .4570,  .4600,  .5120,  .5140,  .5130,  .4570,           SAT
     C        .1340,  .0980,  .1270,  .1100,  .1000,  .1340,           SAT
     D        .0540,  .0390,  .0480,  .0200,  .0200,  .0540,           SAT
     E        .0240,  .0200,  .0170,  .0090,  .0070,  .0240,           SAT
     F        .0110,  .0070,  .0100,  .0040,  .0030,  .0110,           SAT
     G        .0070,  .0050,  .0050,  .0010,  .0010,  .0070,           SAT
     H        .0050,  .0030,  .0020,  .0010,  .0010,  .0050,           SAT
     I        .0030,  .0020,  .0030,  .0010,  .0000,  .0030,           SAT
     J        .0030,  .0010,  .0003,  .0000,  .0003,  .0030,           SAT
     K        .0040,  .0010,  .0010,  .0010,  .0002,  .0040,           SAT
     L        .0010,  .0003,  .0000,  .0000,  .0003,  .0010,           SAT
     M        .0010,  .0001,  .0000,  .0000,  .0002,  .0010/           SAT
      DATA ((POLFR1(I,J,2),J=1,6),I=14,25)/
     N        .0010,  .0000,  .0000,  .0000,  .0000,  .0010,           SAT
     O        .0000,  .0000,  .0000,  .0000,  .0002,  .0000,           SAT
     P        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           SAT
     O        .0000,  .0000,  .0000,  .0000,  .0002,  .0000,           SAT
     R        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           SAT
     S        .0000,  .0000,  .0000,  .0000,  .0010,  .0000,           SAT
     T        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           SAT
     U        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           SAT
     V        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           SAT
     W        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           SAT
     X        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,           SAT
     Y        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/           SAT
```

```
      DATA ((POLFR1(I,J,3),J=1,6),I=1,13)/
     A        .2820,  .3650,  .4300,  .3660,  .4010,  .3010,                    SUN
     B        .4870,  .4570,  .4370,  .4910,  .5210,  .4680,                    SUN
     C        .1220,  .0880,  .0730,  .0870,  .0580,  .1350,                    SUN
     D        .0490,  .0400,  .0270,  .0310,  .0160,  .0510,                    SUN
     E        .0240,  .0210,  .0140,  .0100,  .0030,  .0220,                    SUN
     F        .0120,  .0100,  .0090,  .0090,  .0002,  .0110,                    SUN
     G        .0080,  .0080,  .0040,  .0030,  .0002,  .0050,                    SUN
     H        .0060,  .0050,  .0040,  .0020,  .0002,  .0030,                    SUN
     I        .0040,  .0010,  .0010,  .0003,  .0000,  .0010,                    SUN
     J        .0050,  .0020,  .0020,  .0000,  .0001,  .0010,                    SUN
     K        .0010,  .0020,  .0010,  .0000,  .0000,  .0004,                    SUN
     L        .0020,  .0010,  .0000,  .0000,  .0001,  .0003,                    SUN
     M        .0000,  .0000,  .0000,  .0000,  .0000,  .0003/                    SUN
      DATA ((POLFR1(I,J,3),J=1,6),I=14,25)/
     N        .0000,  .0010,  .0000,  .0003,  .0000,  .0001,                    SUN
     O        .0010,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     P        .0000,  .0000,  .0010,  .0000,  .0000,  .0000,                    SUN
     O        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     R        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     S        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     T        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     U        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     V        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     W        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     X        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    SUN
     Y        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                    SUN
      DATA ((POLFR2(I,J,1),J=1,6),I=1,13)/
     A        .3440,  .2500,  .0810,  .1070,  .0760,  .1190,                    WKD
     B        .4220,  .4080,  .2820,  .3700,  .3250,  .3700,                    WKD
     C        .1290,  .1470,  .1980,  .2020,  .2130,  .2210,                    WKD
     D        .0520,  .0860,  .1270,  .1160,  .1260,  .1210,                    WKD
     E        .0220,  .0490,  .0900,  .0810,  .0820,  .0670,                    WKD
     F        .0120,  .0250,  .0620,  .0500,  .0550,  .0370,                    WKD
     G        .0060,  .0120,  .0450,  .0320,  .0400,  .0230,                    WKD
     H        .0040,  .0090,  .0340,  .0190,  .0280,  .0140,                    WKD
     I        .0020,  .0050,  .0260,  .0110,  .0190,  .0090,                    WKD
     J        .0020,  .0030,  .0150,  .0060,  .0110,  .0050,                    WKD
     K        .0020,  .0030,  .0130,  .0040,  .0080,  .0040,                    WKD
     L        .0010,  .0004,  .0080,  .0020,  .0050,  .0030,                    WKD
     M        .0010,  .0010,  .0060,  .0010,  .0040,  .0020/                    WKD
      DATA ((POLFR2(I,J,1),J=1,6),I=14,25)/
     N        .0003,  .0010,  .0040,  .0004,  .0030,  .0010,                    WKD
     O        .0010,  .0002,  .0050,  .0010,  .0030,  .0020,                    WKD
     P        .0003,  .0010,  .0040,  .0002,  .0010,  .0010,                    WKD
     O        .0001,  .0000,  .0010,  .0001,  .0010,  .0010,                    WKD
     R        .0001,  .0000,  .0003,  .0000,  .0004,  .0003,                    WKD
     S        .0000,  .0000,  .0002,  .0000,  .0001,  .0002,                    WKD
     T        .0000,  .0000,  .0001,  .0000,  .0004,  .0002,                    WKD
     U        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    WKD
     V        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    WKD
     W        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    WKD
     X        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                    WKD
     Y        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                    WKD
      DATA ((POLFR2(I,J,2),J=1,6),I=1,13)/
     A        .1440,  .2900,  .2430,  .1700,  .1600,  .1240,                    SAT
     B        .3710,  .4180,  .4400,  .4370,  .4390,  .3590,                    SAT
     C     .1750,  .1390,  .1500,  .2030,  .2040,  .2260,                  SAT
     D     .1150,  .0740,  .0820,  .0860,  .0810,  .1120,                  SAT
     E     .0700,  .0310,  .0330,  .0450,  .0550,  .0690,                  SAT
     F     .0460,  .0150,  .0210,  .0250,  .0240,  .0390,                  SAT
     G     .0330,  .0130,  .0090,  .0140,  .0120,  .0210,                  SAT
     H     .0130,  .0050,  .0090,  .0090,  .0090,  .0190,                  SAT
     I     .0120,  .0060,  .0070,  .0040,  .0070,  .0090,                  SAT
     J     .0010,  .0020,  .0000,  .0020,  .0040,  .0060,                  SAT
     K     .0020,  .0020,  .0000,  .0010,  .0020,  .0060,                  SAT
     L     .0060,  .0010,  .0010,  .0010,  .0010,  .0030,                  SAT
     M     .0020,  .0010,  .0020,  .0004,  .0010,  .0020/                  SAT
      DATA ((POLFR2(I,J,2),J=1,6),I=14,25)/
     N     .0040,  .0010,  .0010,  .0010,  .0010,  .0010,                  SAT
     O     .0020,  .0010,  .0000,  .0010,  .0000,  .0010,                  SAT
     P     .0010,  .0010,  .0020,  .0003,  .0000,  .0010,                  SAT
     O     .0000,  .0002,  .0000,  .0001,  .0000,  .0010,                  SAT
     R     .0010,  .0002,  .0000,  .0000,  .0003,  .0010,                  SAT
     S     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     T     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     U     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     V     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     W     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     X     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     Y     .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                  SAT
      DATA ((POLFR2(I,J,3),J=1,6),I=1,13)/
     A     .1950,  .3330,  .2880,  .2270,  .1790,  .2050,                  SUN
     R     .3600,  .4160,  .4710,  .4950,  .4180,  .3880,                  SUN
     C     .1840,  .1330,  .1370,  .1490,  .2000,  .1870,                  SUN
     D     .0940,  .0500,  .0530,  .0540,  .0840,  .0940,                  SUN
     E     .0560,  .0260,  .0260,  .0310,  .0450,  .0500,                  SUN
     F     .0400,  .0130,  .0110,  .0200,  .0280,  .0290,                  SUN
     G     .0300,  .0110,  .0060,  .0080,  .0190,  .0160,                  SUN
     H     .0150,  .0060,  .0020,  .0060,  .0070,  .0100,                  SUN
     I     .0110,  .0060,  .0040,  .0060,  .0050,  .0070,                  SUN
     J     .0080,  .0010,  .0000,  .0020,  .0050,  .0050,                  SUN
     K     .0030,  .0010,  .0010,  .0020,  .0030,  .0040,                  SUN
     L     .0010,  .0004,  .0002,  .0010,  .0020,  .0030,                  SUN
     M     .0010,  .0004,  .0000,  .0000,  .0010,  .0020/                  SUN
      DATA ((POLFR2(I,J,3),J=1,6),I=14,25)/
     N     .0010,  .0010,  .0000,  .0000,  .0010,  .0010,                  SUN
     O     .0010,  .0004,  .0000,  .0000,  .0002,  .0010,                  SUN
     P     .0010,  .0010,  .0000,  .0000,  .0010,  .0000,                  SUN
     O     .0000,  .0010,  .0000,  .0000,  .0000,  .0000,                  SUN
     R     .0010,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     S     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     T     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     U     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     V     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     W     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     X     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     Y     .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                  SUN
      DATA ((POLFR3(I,J,1),J=1,6),I=1,13)/
     A     .4550,  .2570,  .1870,  .2830,  .2510,  .2670,                  WKD
     R     .3690,  .3970,  .3550,  .3900,  .3790,  .4580,                  WKD
     C     .0920,  .1760,  .2140,  .2180,  .2110,  .1560,                  WKD
     D     .0420,  .0670,  .1120,  .0710,  .0840,  .0540,                  WKD
     E     .0200,  .0370,  .0530,  .0190,  .0370,  .0240,                  WKD
     F        .0110,  .0220,  .0290,  .0090,  .0200,  .0120,                     WKD
     G        .0070,  .0140,  .0150,  .0040,  .0100,  .0080,                     WKD
     H        .0020,  .0160,  .0130,  .0030,  .0030,  .0070,                     WKD
     I        .0010,  .0060,  .0060,  .0010,  .0020,  .0040,                     WKD
     J        .0020,  .0040,  .0060,  .0010,  .0010,  .0030,                     WKD
     K        .0010,  .0020,  .0020,  .0010,  .0010,  .0020,                     WKD
     L        .0003,  .0020,  .0030,  .0001,  .0010,  .0020,                     WKD
     M        .0000,  .0000,  .0020,  .0001,  .0003,  .0010/                     WKD
      DATA ((POLFR3(I,J,1),J=1,6),I=14,25)/
     N        .0000,  .0000,  .0020,  .0001,  .0003,  .0010,                     WKD
     O        .0000,  .0000,  .0010,  .0002,  .0000,  .0010,                     WKD
     P        .0000,  .0000,  .0003,  .0001,  .0000,  .0010,                     WKD
     Q        .0000,  .0000,  .0003,  .0000,  .0000,  .0000,                     WKD
     R        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     WKD
     S        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     WKD
     T        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     WKD
     U        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     WKD
     V        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     WKD
     W        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     WKD
     X        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     WKD
     Y        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                     WKD
      DATA ((POLFR3(I,J,2),J=1,6),I=1,13)/
     A        .3330,  .3850,  .4640,  .3320,  .2980,  .2580,                     SAT
     B        .3830,  .4020,  .3480,  .4520,  .5260,  .4870,                     SAT
     C        .1390,  .0960,  .0920,  .1310,  .1300,  .1470,                     SAT
     D        .0460,  .0530,  .0490,  .0510,  .0340,  .0530,                     SAT
     E        .0370,  .0210,  .0290,  .0180,  .0120,  .0180,                     SAT
     F        .0280,  .0150,  .0060,  .0050,  .0000,  .0130,                     SAT
     G        .0090,  .0100,  .0000,  .0040,  .0000,  .0090,                     SAT
     H        .0090,  .0060,  .0050,  .0020,  .0000,  .0050,                     SAT
     I        .0060,  .0050,  .0030,  .0020,  .0000,  .0040,                     SAT
     J        .0030,  .0010,  .0020,  .0020,  .0000,  .0020,                     SAT
     K        .0030,  .0020,  .0030,  .0004,  .0000,  .0030,                     SAT
     L        .0030,  .0010,  .0000,  .0000,  .0000,  .0000,                     SAT
     M        .0000,  .0020,  .0000,  .0000,  .0000,  .0000/                     SAT
      DATA ((POLFR3(I,J,2),J=1,6),I=14,25)/
     N        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     O        .0000,  .0000,  .0000,  .0000,  .0000,  .0004,                     SAT
     P        .0000,  .0000,  .0000,  .0000,  .0000,  .0004,                     SAT
     Q        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     R        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     S        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     T        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     U        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     V        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     W        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     X        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                     SAT
     Y        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                     SAT
      DATA ((POLFR3(I,J,3),J=1,6),I=1,13)/
     A        .3290,  .4330,  .3660,  .3520,  .3050,  .3240,                     SUN
     B        .4290,  .3530,  .4680,  .5320,  .4900,  .4330,                     SUN
     C        .1220,  .1230,  .1160,  .0960,  .1350,  .1430,                     SUN
     D        .0560,  .0450,  .0270,  .0110,  .0400,  .0420,                     SUN
     E        .0150,  .0160,  .0070,  .0060,  .0140,  .0250,                     SUN
     F        .0190,  .0110,  .0090,  .0020,  .0090,  .0120,                     SUN
     G        .0170,  .0110,  .0040,  .0010,  .0030,  .0120,                     SUN
     H        .0050,  .0060,  .0020,  .0010,  .0000,  .0080,                     SUN
     I        .0050,  .0030,  .0010,  .0010,  .0030,  .0020,                      SUN
     J        .0010,  .0010,  .0010,  .0000,  .0000,  .0010,                      SUN
     K        .0020,  .0000,  .0010,  .0000,  .0000,  .0000,                      SUN
     L        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     M        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                      SUN
      DATA ((POLFR3(I,J,3),J=1,6),I=14,25)/
     N        .0010,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     O        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     P        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     Q        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     R        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     S        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     T        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     U        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     V        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     W        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     X        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      SUN
     Y        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                      SUN
      DATA ((POLFR4(I,J,1),J=1,6),I=1,13)/
     A        .5280,  .3980,  .2240,  .4300,  .3510,  .3120,                      WKD
     B        .3320,  .4150,  .4080,  .4260,  .4290,  .4140,                      WKD
     C        .0780,  .1120,  .1730,  .0990,  .1320,  .1370,                      WKD
     D        .0290,  .0440,  .0770,  .0290,  .0500,  .0600,                      WKD
     E        .0120,  .0170,  .0420,  .0080,  .0200,  .0280,                      WKD
     F        .0090,  .0080,  .0240,  .0040,  .0090,  .0170,                      WKD
     G        .0040,  .0030,  .0150,  .0010,  .0030,  .0100,                      WKD
     H        .0030,  .0020,  .0120,  .0010,  .0020,  .0070,                      WKD
     I        .0020,  .0010,  .0080,  .0010,  .0010,  .0040,                      WKD
     J        .0010,  .0004,  .0050,  .0001,  .0010,  .0030,                      WKD
     K        .0010,  .0004,  .0040,  .0002,  .0002,  .0020,                      WKD
     L        .0004,  .0000,  .0030,  .0001,  .0003,  .0020,                      WKD
     M        .0004,  .0002,  .0020,  .0001,  .0004,  .0020/                      WKD
      DATA ((POLFR4(I,J,1),J=1,6),I=14,25)/
     N        .0003,  .0002,  .0020,  .0002,  .0003,  .0010,                      WKD
     O        .0003,  .0000,  .0020,  .0001,  .0000,  .0010,                      WKD
     P        .0001,  .0000,  .0010,  .0001,  .0001,  .0010,                      WKD
     Q        .0001,  .0000,  .0003,  .0000,  .0001,  .0001,                      WKD
     R        .0001,  .0000,  .0001,  .0000,  .0000,  .0002,                      WKD
     S        .0001,  .0000,  .0001,  .0000,  .0000,  .0002,                      WKD
     T        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      WKD
     U        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      WKD
     V        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      WKD
     W        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      WKD
     X        .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                      WKD
     Y        .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                      WKD
      DATA ((POLFR4(I,J,2),J=1,6),I=1,13)/
     A        .3910,  .4860,  .4040,  .4880,  .4140,  .2960,                      SAT
     B        .3760,  .3380,  .4260,  .4130,  .4380,  .4300,                      SAT
     C        .1130,  .0940,  .1030,  .0790,  .1030,  .1420,                      SAT
     D        .0450,  .0400,  .0310,  .0150,  .0300,  .0580,                      SAT
     E        .0300,  .0130,  .0130,  .0020,  .0070,  .0270,                      SAT
     F        .0170,  .0110,  .0070,  .0010,  .0050,  .0160,                      SAT
     G        .0090,  .0050,  .0060,  .0002,  .0030,  .0100,                      SAT
     H        .0050,  .0060,  .0040,  .0004,  .0000,  .0060,                      SAT
     I        .0030,  .0030,  .0020,  .0000,  .0000,  .0050,                      SAT
     J        .0010,  .0020,  .0010,  .0002,  .0000,  .0040,                      SAT
     K        .0030,  .0020,  .0010,  .0004,  .0000,  .0020,                      SAT
     L       .0020,  .0010,  .0010,  .0000,  .0000,  .0010,                 SAT
     M       .0010,  .0003,  .0010,  .0000,  .0000,  .0010/                 SAT
      DATA ((POLFR4(I,J,2),J=1,6),I=14,25)/
     N       .0010,  .0003,  .0002,  .0000,  .0000,  .0010,                 SAT
     O       .0030,  .0000,  .0002,  .0000,  .0000,  .0010,                 SAT
     P       .0010,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     Q       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     R       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     S       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     T       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     U       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     V       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     W       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     X       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SAT
     Y       .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                 SAT
      DATA ((POLFR4(I,J,3),J=1,6),I=1,13)/
     A       .3800,  .4500,  .4790,  .5170,  .4580,  .3600,                 SUN
     B       .3900,  .3570,  .3810,  .4040,  .4210,  .4070,                 SUN
     C       .1110,  .0970,  .0770,  .0600,  .0770,  .1180,                 SUN
     D       .0450,  .0340,  .0300,  .0130,  .0300,  .0530,                 SUN
     E       .0280,  .0240,  .0150,  .0030,  .0080,  .0240,                 SUN
     F       .0210,  .0160,  .0090,  .0020,  .0040,  .0160,                 SUN
     G       .0110,  .0090,  .0060,  .0004,  .0000,  .0100,                 SUN
     H       .0050,  .0040,  .0030,  .0000,  .0000,  .0040,                 SUN
     I       .0030,  .0040,  .0010,  .0000,  .0000,  .0040,                 SUN
     J       .0030,  .0030,  .0002,  .0001,  .0000,  .0010,                 SUN
     K       .0020,  .0020,  .0002,  .0000,  .0000,  .0020,                 SUN
     L       .0010,  .0010,  .0000,  .0000,  .0010,  .0010,                 SUN
     M       .0010,  .0000,  .0000,  .0000,  .0000,  .0000/                 SUN
      DATA ((POLFR4(I,J,3),J=1,6),I=14,25)/
     N       .0010,  .0010,  .0000,  .0000,  .0000,  .0002,                 SUN
     O       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     P       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     Q       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     R       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     S       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     T       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     U       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     V       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     W       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     X       .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                 SUN
     Y       .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                 SUN
      DATA ((POLFR5(I,J,1),J=1,6),I=1,13)/
     A       .3330,  .4610,  .3230,  .1540,  .2270,  .1900,                 WKD
     B       .3950,  .3670,  .4380,  .3440,  .4160,  .3740,                 WKD
     C       .1290,  .0920,  .1220,  .1990,  .2110,  .2030,                 WKD
     D       .0520,  .0320,  .0550,  .1150,  .0800,  .0960,                 WKD
     E       .0280,  .0160,  .0260,  .0650,  .0340,  .0510,                 WKD
     F       .0140,  .0090,  .0160,  .0390,  .0160,  .0280,                 WKD
     G       .0120,  .0080,  .0070,  .0240,  .0080,  .0180,                 WKD
     H       .0080,  .0040,  .0050,  .0160,  .0030,  .0120,                 WKD
     I       .0060,  .0040,  .0030,  .0100,  .0020,  .0080,                 WKD
     J       .0040,  .0030,  .0020,  .0090,  .0010,  .0050,                 WKD
     K       .0040,  .0010,  .0005,  .0070,  .0004,  .0040,                 WKD
     L       .0040,  .0010,  .0005,  .0040,  .0004,  .0030,                 WKD
     M       .0030,  .0010,  .0010,  .0030,  .0002,  .0030/                 WKD
      DATA ((POLFR5(I,J,1),J=1,6),I=14,25)/
     N      .0030,  .0004,  .0000,  .0020,  .0002,  .0020,          WKD
     O      .0010,  .0010,  .0002,  .0030,  .0002,  .0030,          WKD
     P      .0020,  .0004,  .0002,  .0020,  .0000,  .0020,          WKD
     Q      .0002,  .0001,  .0000,  .0010,  .0000,  .0010,          WKD
     R      .0002,  .0000,  .0000,  .0004,  .0000,  .0003,          WKD
     S      .0000,  .0000,  .0000,  .0002,  .0000,  .0001,          WKD
     T      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          WKD
     U      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          WKD
     V      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          WKD
     W      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          WKD
     X      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          WKD
     Y      .0000,  .0000,  .0000,  .0000,  .0000,  .0000/          WKD
      DATA ((POLFR5(I,J,2),J=1,6),I=1,13)/
     A      .2810,  .4230,  .3120,  .2370,  .2250,  .1910,          SAT
     B      .3770,  .3660,  .4090,  .4290,  .4510,  .3720,          SAT
     C      .1490,  .0970,  .1530,  .2110,  .1980,  .1940,          SAT
     D      .0750,  .0470,  .0510,  .0650,  .0580,  .0960,          SAT
     E      .0470,  .0270,  .0290,  .0240,  .0260,  .0520,          SAT
     F      .0210,  .0110,  .0180,  .0130,  .0130,  .0290,          SAT
     G      .0130,  .0070,  .0060,  .0070,  .0120,  .0180,          SAT
     H      .0100,  .0040,  .0040,  .0050,  .0070,  .0130,          SAT
     I      .0060,  .0020,  .0060,  .0030,  .0050,  .0130,          SAT
     J      .0020,  .0050,  .0050,  .0020,  .0020,  .0060,          SAT
     K      .0020,  .0020,  .0050,  .0020,  .0000,  .0050,          SAT
     L      .0020,  .0020,  .0000,  .0010,  .0020,  .0030,          SAT
     M      .0040,  .0010,  .0000,  .0002,  .0010,  .0020/          SAT
      DATA ((POLFR5(I,J,2),J=1,6),I=14,25)/
     N      .0020,  .0010,  .0010,  .0003,  .0000,  .0010,          SAT
     O      .0020,  .0010,  .0000,  .0002,  .0003,  .0030,          SAT
     P      .0050,  .0010,  .0000,  .0000,  .0000,  .0020,          SAT
     Q      .0020,  .0000,  .0000,  .0000,  .0000,  .0004,          SAT
     R      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          SAT
     S      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          SAT
     T      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          SAT
     U      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          SAT
     V      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          SAT
     W      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          SAT
     X      .0000,  .0000,  .0000,  .0000,  .0000,  .0000,          SAT
     Y      .0000,  .0000,  .0000,  .0000,  .0000,  .0000/          SAT
      DATA ((POLFR5(I,J,3),J=1,6),I=1,13)/
     A      .3240,  .4420,  .3860,  .3540,  .3410,  .2740,          SUN
     B      .3640,  .3780,  .4150,  .4440,  .4480,  .3760,          SUN
     C      .1480,  .0880,  .1110,  .1380,  .1430,  .1770,          SUN
     D      .0630,  .0400,  .0400,  .0360,  .0370,  .0790,          SUN
     E      .0310,  .016C,  .0120,  .0140,  .0190,  .0360,          SUN
     F      .0180,  .0130,  .0170,  .0070,  .0060,  .0200,          SUN
     G      .0150,  .0070,  .0090,  .0030,  .0020,  .0120,          SUN
     H      .0100,  .0040,  .0010,  .0020,  .0010,  .0080,          SUN
     I      .0050,  .0050,  .0020,  .0010,  .0010,  .0050,          SUN
     J      .0070,  .0020,  .0040,  .0010,  .0002,  .0040,          SUN
     K      .0050,  .0010,  .0020,  .0005,  .0000,  .0030,          SUN
     L      .0050,  .0020,  .0000,  .0000,  .0005,  .0020,          SUN
     M      .0020,  .0010,  .0000,  .0000,  .0000,  .0010/          SUN
      DATA ((POLFR5(I,J,3),J=1,6),I=14,25)/
     N      .0010,  .0010,  .0000,  .0000,  .0000,  .0020,          SUN
     O      .0010,  .0000,  .0000,  .0000,  .0000,  .0010,          SUN
     P      .0020,  .0000,  .0000,  .0000,  .0000,  .0003,          SUN
     Q     .0003,  .0000,  .0000,  .0000,  .0000,  .0003,             SUN
     R     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SUN
     S     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SUN
     T     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SUN
     U     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SUN
     V     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SUN
     W     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SUN
     X     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SUN
     Y     .0000,  .0000,  .0000,  .0000,  .0000,  .0000/             SUN
      DATA ((POLFR6(I,J,1),J=1,6),I=1,13)/
     A     .3880,  .4550,  .2310,  .2090,  .3940,  .3280,             WKD
     B     .3740,  .3550,  .4300,  .4200,  .4010,  .3980,             WKD
     C     .1100,  .0780,  .1370,  .1720,  .1150,  .1360,             WKD
     D     .0460,  .0430,  .0530,  .0730,  .0510,  .0600,             WKD
     E     .0290,  .0220,  .0480,  .0350,  .0190,  .0280,             WKD
     F     .0110,  .0120,  .0220,  .0250,  .0090,  .0130,             WKD
     G     .0080,  .0120,  .0210,  .0120,  .0040,  .0090,             WKD
     H     .0070,  .0060,  .0160,  .0100,  .0020,  .0080,             WKD
     I     .0080,  .0050,  .0140,  .0110,  .0010,  .0040,             WKD
     J     .0050,  .0040,  .0090,  .0060,  .0010,  .0030,             WKD
     K     .0060,  .0040,  .0110,  .0090,  .0020,  .0030,             WKD
     L     .0020,  .0010,  .0030,  .0030,  .0003,  .0020,             WKD
     M     .0000,  .0010,  .0020,  .0040,  .0004,  .0020/             WKD
      DATA ((POLFR6(I,J,1),J=1,6),I=14,25)/
     N     .0030,  .0004,  .0020,  .0030,  .0000,  .0020,             WKD
     O     .0030,  .0010,  .0010,  .0040,  .0000,  .0010,             WKD
     P     .0010,  .0003,  .0000,  .0020,  .0000,  .0020,             WKD
     Q     .0000,  .0000,  .0000,  .0004,  .0000,  .0010,             WKD
     R     .0000,  .0000,  .0000,  .0000,  .0000,  .0002,             WKD
     S     .0000,  .0000,  .0000,  .0000,  .0000,  .0001,             WKD
     T     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             WKD
     U     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             WKD
     V     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             WKD
     W     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             WKD
     X     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             WKD
     Y     .0000,  .0000,  .0000,  .0000,  .0000,  .0000/             WKD
      DATA ((POLFR6(I,J,2),J=1,6),I=1,13)/
     A     .3630,  .4440,  .3240,  .4240,  .4450,  .2990,             SAT
     B     .3540,  .2960,  .4320,  .4190,  .4170,  .3910,             SAT
     C     .1150,  .0990,  .1300,  .1030,  .0900,  .1450,             SAT
     D     .0660,  .0640,  .0410,  .0280,  .0250,  .0600,             SAT
     E     .0390,  .0220,  .0200,  .0130,  .0120,  .0300,             SAT
     F     .0210,  .0370,  .0190,  .0030,  .0060,  .0200,             SAT
     G     .0130,  .0170,  .0160,  .0020,  .0030,  .0190,             SAT
     H     .0090,  .0050,  .0040,  .0000,  .0000,  .0060,             SAT
     I     .0030,  .0020,  .0020,  .0000,  .0010,  .0090,             SAT
     J     .0020,  .0020,  .0010,  .0000,  .0000,  .0060,             SAT
     K     .0020,  .0000,  .0040,  .0080,  .0020,  .0050,             SAT
     L     .0000,  .0020,  .0010,  .0000,  .0000,  .0020,             SAT
     M     .0030,  .0030,  .0040,  .0000,  .0000,  .0020/             SAT
      DATA ((POLFR6(I,J,2),J=1,6),I=14,25)/
     N     .0010,  .0050,  .0010,  .0000,  .0000,  .0020,             SAT
     O     .0030,  .0030,  .0000,  .0000,  .0000,  .0020,             SAT
     P     .0050,  .0000,  .0000,  .0000,  .0000,  .0010,             SAT
     Q     .0010,  .0000,  .0000,  .0000,  .0000,  .0000,             SAT
     R     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SAT
     S     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,             SAT
     T     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     U     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     V     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     W     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     X     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SAT
     Y     .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                  SAT
      DATA ((POLFR6(I,J,3),J=1,6),I=1,13)/
     A     .3440,  .4120,  .4310,  .5210,  .4400,  .3460,                  SUN
     B     .3840,  .3440,  .4080,  .3900,  .3880,  .4070,                  SUN
     C     .1070,  .0860,  .0880,  .0620,  .1000,  .1330,                  SUN
     D     .0550,  .0540,  .0260,  .0150,  .0400,  .0490,                  SUN
     E     .0310,  .0360,  .0210,  .0030,  .0130,  .0180,                  SUN
     F     .0160,  .0250,  .0070,  .0050,  .0070,  .0070,                  SUN
     G     .0090,  .0120,  .0070,  .0030,  .0050,  .0090,                  SUN
     H     .0220,  .0100,  .0030,  .0000,  .0030,  .0090,                  SUN
     I     .0150,  .0060,  .0040,  .0000,  .0020,  .0050,                  SUN
     J     .0000,  .0030,  .0020,  .0000,  .0000,  .0070,                  SUN
     K     .0070,  .0030,  .0010,  .0000,  .0020,  .0040,                  SUN
     L     .0050,  .0030,  .0010,  .0000,  .0000,  .0010,                  SUN
     M     .0040,  .0030,  .0000,  .0010,  .0000,  .0030/                  SUN
      DATA ((POLFR6(I,J,3),J=1,6),I=14,25)/
     N     .0000,  .0010,  .0000,  .0010,  .0000,  .0010,                  SUN
     O     .0000,  .0020,  .0000,  .0000,  .0000,  .0010,                  SUN
     P     .0020,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     Q     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     R     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     S     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     T     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     U     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     V     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     W     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     X     .0000,  .0000,  .0000,  .0000,  .0000,  .0000,                  SUN
     Y     .0000,  .0000,  .0000,  .0000,  .0000,  .0000/                  SUN
      END
      BLOCK DATA RURCON
      COMMON/PLFRC3/ POLFR8(25,6,3)
      DATA ((POLFR8(I,J,1),J=1,6),I=1,13)/
     A          .5000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     B          .3000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     C          .1500,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     D          .0500,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     E          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     F          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     G          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     H          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     I          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     J          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     K          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     L          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     M          .0000,   .0000,   .0000,   .0000,   .0000,   .0000/          WKD
      DATA ((POLFR8(I,J,1),J=1,6),I=14,25)/
     N          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     O          .0000,   .0C00,   .0000,   .0000,   .0000,   .0000,          WKD
     P          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     Q          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     R          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     S          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     T          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     U          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     V          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     W          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     X          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          WKD
     Y          .0000,   .0000,   .0000,   .0000,   .0000,   .0000/          WKD
      DATA ((POLFR8(I,J,2),J=1,6),I=1,13)/
     A          .5000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     B          .3000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     C          .1500,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     D          .0500,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     E          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     F          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     G          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     H          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     I          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     J          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     K          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     L          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     M          .0000,   .0000,   .0000,   .0000,   .0000,   .0000/          SAT
      DATA ((POLFR8(I,J,2),J=1,6),I=14,25)/
     N          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     O          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     P          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     Q          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     R          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     S          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     T          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     U          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     V          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     W          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     X          .0000,   .0000,   .0000,   .0000,   .0000,   .0000,          SAT
     Y          .0000,   .0000,   .0000,   .0000,   .0000,   .0000/          SAT
      DATA ((POLFR8(I,J,3),J=1,6),I=1,13)/
```

```
BLOCK DATA RURCON     73/74    OPT=1  PMDMP                    FTN 4.8+552       84/07/09. 16.17.07      PAGE     2
     A    .5000, .0000, .0000, .0000, .0000, .0000,                       SUN
     B    .3000, .0000, .0000, .0000, .0000, .0000,                       SUN
     C    .1500, .0000, .0000, .0000, .0000, .0000,                       SUN
     D    .0500, .0000, .0000, .0000, .0000, .0000,                       SUN
     E    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     F    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     G    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     H    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     I    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     J    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     K    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     L    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     M    .0000, .0000, .0000, .0000, .0000, .0000/                       SUN
      DATA ((POLFR8(I,J,3),J=1,6),I=14,25)/
     N    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     O    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     P    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     Q    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     R    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     S    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     T    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     U    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     V    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     W    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     X    .0000, .0000, .0000, .0000, .0000, .0000,                       SUN
     Y    .0000, .0000, .0000, .0000, .0000, .0000/                       SUN
      END
```

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.
EPA 460/3-85-002

2.

3. RECIPIENT'S ACCESSION NO.

4. TITLE AND SUBTITLE
IMPROVED MOBILE SOURCE EXPOSURE ESTIMATION

5. REPORT DATE
March 1985

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)
Melvin N. Ingalls

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Southwest Research Institute
6220 Culebra Road
San Antonio, Texas 78284

10. PROGRAM ELEMENT NO.
Work Assignment 6

11. CONTRACT/GRANT NO.
68-03-3162

12. SPONSORING AGENCY NAME AND ADDRESS
Environmental Protection Agency
2565 Plymouth Road
Ann Arbor, Michigan 48105

13. TYPE OF REPORT AND PERIOD COVERED
Final Report (1/84 to 6/84)

14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This project was conducted to provide an improved estimate of nationwide annual person hours of exposure to non-reactive mobile source pollutants. National population estimates by hour of the day were developed using the population activity files for six neighborhood types from the EPA NAAQS Exposure Model (NEM) for CO, with the addition of three mobile source microenvironments (street canyons, tunnels and parking garages). The NEM neighborhood populations together with the mobile source microenvironment populations constitute a complete hour-by-hour assignment of the nationwide population to a set of location types. Mobile source pollutant concentrations for the six NEM neighborhoods were derived from 1981 CO monitor data contained in the EPA SAROAD data base. Mobile source pollutant concentrations for the three mobile source microenvironments were derived for data in the literature. A computer program was written to combine the population and pollutant concentration distributions by hour of the day to produce an annual person hours of exposure distribution of mobile source pollutants. If the mobile source emission rate of a pollutant is known, the information in this report can be used to determine the person hours of exposure to various concentrations of that pollutant.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Exhaust Emissions Motor Vehicles	Exposure Estimates Parking Garages Tunnels Street Canyons	

18. DISTRIBUTION STATEMENT
Release Unlimited

19. SECURITY CLASS *(This Report)*
Unclassified

20. SECURITY CLASS *(This page)*
Unclassified

21. NO. OF PAGES
214

22. PRICE

EPA Form 2220-1 (9-73)